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ABSTRACT

This guide, which is one of the curriculum guides in the "Exploration Curriculum Development Initiative" (Exploration) series intended to assist junior high and middle school industrial educators in helping their students explore diverse industrial situations and technologies used in industry, deals with using the language of industry. The following topics are covered in the individual lessons: introduction to drafting (drafting applications and the communication process); sketching single-view, pictorial, and multiview drawings; reading multiview drawings; developing an architectural floor plan (architectural drawing and procedures for developing a floor plan); reading an architectural floor plan (reading plans and identifying positive features and flaws in them); sketching a schematic diagram (symbols used in schematic diagrams and sketching procedures); reading schematic diagrams; sketching graphs and charts; and reading graphs and charts. The guide includes the rationale behind its development, hints to the teacher, lesson plans, student handout masters, teacher aids, a unit examination, and a list of references. The lesson plans include cross-referenced lists of objectives, lesson content, and learning activities. (MN)

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The Illinois
Plan for Industrial
Education

Illinois
State Board of
Education

Adult,
Vocational and
Technical Education

ED296092

USING THE LANGUAGE OF INDUSTRY

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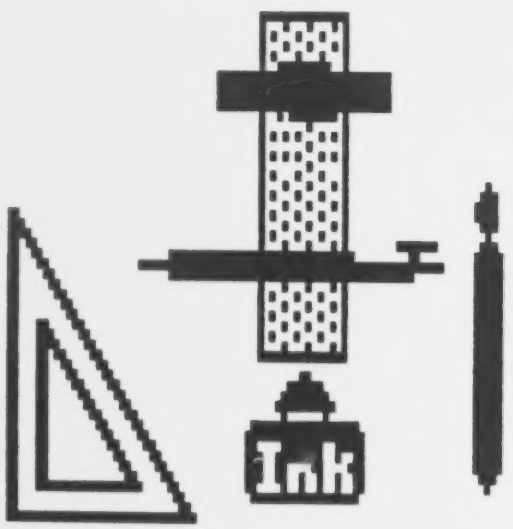

PACKET INCLUDES:

- Rationale
- Hints to the Teacher
- Lesson Plans
- Student Handout Masters
- Teacher Aides
- Unit Examination
- References

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ILLINOIS PLAN FOR INDUSTRIAL EDUCATION

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INTRODUCTION

The development of this publication was made possible through grants from the Illinois State Board of Education, Department of Adult, Vocational and Technical Education, Research and Development Section, 100 North First Street, Springfield, Illinois 62777. Opinions expressed in this document do not reflect, nor should they be construed as policy of the State Board of Education or its staff.

"Using the Language of Industry" is one of a series of curriculum materials developed for junior high and middle school industrial educators. Listed below are the titles of the units in the series.

Communication
- Using the Language of Industry
- Exploring Computer Technology
- Exploring Photography
- Exploring Graphic Communication
- Exploring Electronic Communication

Energy Utilization
- Exploring Solar Energy
- Using Alternate Energy Sources
- Conserving Energy Sources
- Exploring Electricity/Electronics
- Exploring Mechanical and Fluid Systems

Impact of Industry and Technology
- Recycling Materials
- Limiting Pollution
- Exploring Careers in Industry and Technology
- Exploring Technology and the Future

Production
- Exploring Materials and Processes
- Exploring Construction Technology
- Research and Development
- Exploring Manufactured Systems
- Servicing Products

Transportation
- Exploring Land Transportation Systems
- Exploring Aviation Technology
- Exploring Water Transportation Systems
- Exploring Space Transportation Systems
- Exploring Materials Handling Systems

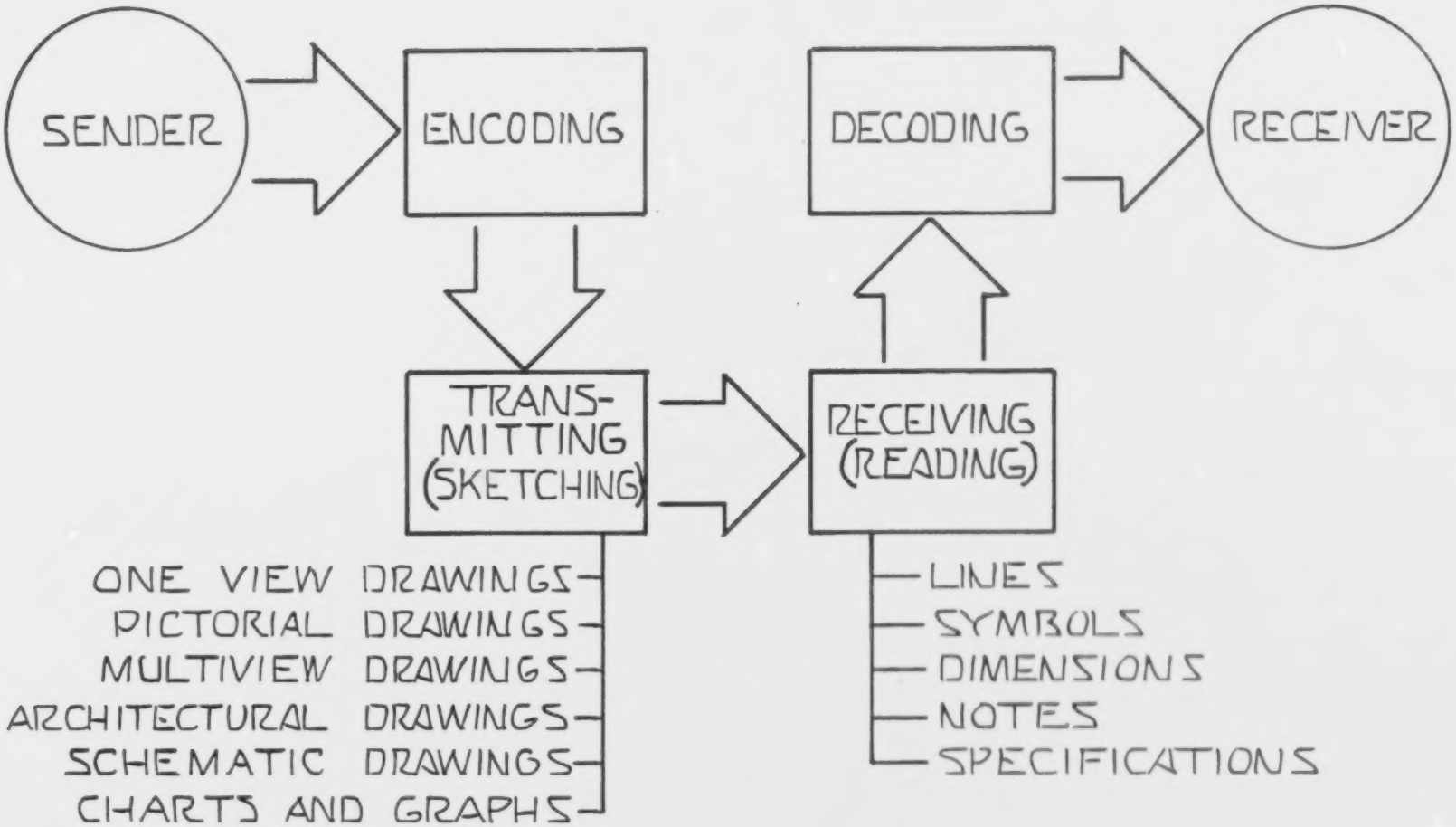
The Exploration Series was developed to help industrial educators provide 7th and 8th grade students an opportunity to explore a wide range of industrial situations as well as some of the technologies used in industry. In addition, these documents can serve as a resource for teachers orienting 9th and 10th grade students to the industrial technologies of communication, production, energy utilization and transportation. Each unit in the series includes a rationale, hints to the teacher, a sample daily schedule, lesson plans, student handouts, teacher aids, a unit examination, and a list of references.

"Using the Language of Industry" and other units in the series are available on a cost recovery basis through the Curriculum Publications Clearinghouse, Western Illinois University, Horrabin Hall 46, Macomb, IL 61455.

RATIONALE

Drawings are an essential means of communication in industry. A collection of images, symbols, numbers, words, and colors can be organized in a picture that is worth more than a thousand words. Drafting, the language of industry, provides an accurate, economical and efficient means of recording and communicating technical information. Drafting is an integral means of communication in manufacturing, construction, communication, energy, transportation, and service industries. Consumers need to be able to read illustrations, floorplans, schematics, charts and graphs to make informed decisions.

Being able to express ideas with a pencil and paper is a basic skill that can enhance all students' ability to communicate. This unit will help students learn how to send and receive technical information through drawings. In addition, this unit will provide students with a basic foundation for further studies in communication technology.


SENDER
ENCODING
DECODING
RECEIVER
TRANS-
MITTING
(SKETCHING)
RECEIVING
(READING)
ONE VIEW DRAWINGS
PICTORIAL DRAWINGS
MULTIVIEW DRAWINGS
ARCHITECTURAL DRAWINGS
SCHEMATIC DRAWINGS
CHARTS AND GRAPHS
LINES
SYMBOLS
DIMENSIONS
NOTES
SPECIFICATIONS

HINTS TO THE TEACHER

1. This unit does not include a lesson on measuring. Some of the activities will require your students to be able to read a ruler. Therefore, you may need to teach your students how to read a ruler before starting this unit.

2. The primary goal of this unit is to provide students with the basic tools and techniques needed to communicate technical information. Therefore, in the spirit of exploration, emphasis has been placed on sketching, visual thinking, using symbols, and experiencing the basic types of drawings used in industry.

3. To help students achieve the objectives in this unit more quickly, it is highly recommended that graph paper be used as a guide. Drawings can be drawn directly on graph paper or graph paper can be used as a guide under plain paper while sketching. Graph paper with 4 or 8 squares to an inch will work with the suggested activities.

4. The subjects provided for the drawings are examples. If you feel a different subject will give more motivation, please use it in place of those provided. For example, you may want your students to sketch a multiview drawing of the project they will mass produce in another unit. Another option is to use the suggested subjects for drawing as projects in future units.

5. Consider displaying all or some of your students' drawings with each topic explored. This could reinforce the value of the communication skills your students are trying to develop. In addition, displaying drawings for all to see will help communicate the value of the unit to those visiting your laboratory.

6. Communication requires at least two people, a sender and a receiver. It is important that your students have opportunities to experience both roles. Therefore, this unit includes the activities of making and reading drawings. If time is limited, integrate the reading of drawings in other units and focus on making drawings during this unit.

7. The main theme in this unit is communication. Evaluate your student's drawings in terms of their communication value. Try not to put too much emphasis on details that do not compromise the communication process.

8. The lesson on orthographic drawing recommends using models as a tool to help students understand the concept of views. The importance of using models cannot be over emphasized. In the interest of time, you may want to make the models for this lesson before beginning this unit.

9. This unit does not include a lesson on using the computer as a drafting tool. Using a computer in an industrial context is explored in a separate unit. However, if you want your students to have at least one experience using the computer during this unit, the activities could be performed using any of the popular CAD programs.

UNIT: Using the Language of Industry

LESSON 1: Introduction to Drafting

Objectives	Lesson Content	Learning Activities	Ref.
A. Following a short introduction, students will be able to: -identify the definitions of drafting -identify applications for drafting -list six basic examples of drafting communication	A. Language of Industry 1. Drafting is: a. called the language of industry. b. preparing drawings for things that need to be made or done. c. an accurate and economical way of developing, recording, and explaining ideas. d. used to communicate ideas 2. Examples of Drafting a. plans for a kit b. charts and graphs c. maps d. football plays e. plans for a house f. illustrations is a service manual	A. Teacher Guided Discussion 1. Ask students what is the best way of telling someone how to make something (through words, through pictures or both). 2. Using OT #1-1, Discuss what drafting is and how it is used in industry.	TA #1-1: Communication Process Activity OT #1-1: Drafting Definition

NOTE:
TA - Teacher Aid
OT - Overhead Transparency
HO - Hand Out

B. During a communication activity, the students will:
- -convert graphic information into words
- -transmit the graphic information verbally
- -receive the verbal information
- -convert verbal information back into graphic form through sketching
- -explain the advantages of drafting over verbal communication

B. The Communication Process
1. sender
2. encoding
3. transmitting
4. receiving
5. decoding
6. receiver

B. Communication Activity

1. Using HO #1-1, discuss the communication process.	HO #1-1: Intro. to Drafting
2. Divide the class into groups of two.	HO #1-2: Communication Process Activity
3. Provide one of the students in each group HO #1-2 and the other students with HO #1-3.	
4. Tell students how to perform the activity.	HO# 1-3: Communication Process Activity
5. Have students do the communication activity.	
6. Following the activity, allow students to exchange handouts and discuss the results of the communication experiment.	
7. Ask students questions about their communication experience.	
8. Have students explain the advantages of graphic forms of communication over verbal communication.	

COMMUNICATION PROCESS ACTIVITY

Introduction:

The communication process is often taken for granted. When there is a failure to communicate, it is important to be able to identify where the failure occurred so corrective action can be taken. This is especially important in industry. Poor communication can be very costly and sometimes dangerous. The purpose of this activity is to provide students with an opportunity to experience and become aware of the communication process.

Referring to HO #1-1, explain the communication process. Specifically, discuss the concepts of sender, encoding, transmitting, receiving, decoding and receiver. (See HO #1-1 for an explanation.)

Divide your class into groups of two. This activity works the best if students are required to sit back to back. Being back to back minimizes the role of non-verbal communication. Provide one member of each group with HO #1-2 and the other member with HO #1-3. Both students will need a pencil. Tell students not to let their partner see illustrations on their handout. Review the directions for round one with your students. Encourage students to refer to positions on the page as part of their encoding process. When you say it is time to begin, the students with HO #1-2 should verbally describe one of the geometric shapes on their handout to their partner. Students with HO #1-3 should try to sketch the geometric from the verbal description provided.

Round Two:

Round two is the same as round one except the student roles are reversed. The students with HO #1-3 are to describe one of the geometric shapes on their handout to their partner. Students with HO #1-2 are to try to sketch the geometric shape from their partner's description. Once the students have completed the activity, allow them to exchange handouts and discuss the results of their communication process.

Summary/Conclusions:

After students have had time to discuss their communication activities, ask them questions about their communication experience. How many teams were able to send and receive messages accurately? Where in the communication process did failure occur? How would you improve the communication process? What are the advantages of graphic forms

of communication over verbal communication? What would happen in industry if they tried to make a product from written and verbal communication only?

DRAFTING IS:

The language of industry

Preparing drawings for things that need to be made or done.

INTRODUCTION TO DRAFTING

What is Drafting:

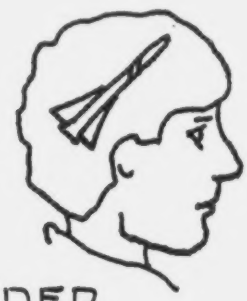
Imagine what it would be like to build a model from a kit without pictures. You would get a plain white box filled with a hundred plastic pieces and several pages of instructions. It would be very difficult to glue part A to part B when you do not even know what they look like. How can you make a model when you don't even know what the final project will look like? Drafting is important in situations like this. When you need to tell someone how to do something or build something, words are often not enough. As the saying goes, "a picture is worth a thousand words." Most of us appreciate pictures when we want to build or do something technical.

People in industry need an accurate and economical way to communicate complicated and technical information. Drafting is often called the "language of industry." Drafting enables people to communicate through pictures, symbols, numbers, colors, and words. Through drafting, people can record, improve, and explain their ideas.

The Communication Process:

Back to wanting to build a model. Imagine the model that you want to make is a rocket. You have never built a rocket before and you want to ask someone with experience for help. You want your rocket to be a certain shape, size, color and more. Your helper will need to understand what you want if he or she is going to be of any help. You need to move the mental picture of the rocket in your mind into the mind of your helper. This process is called communication.

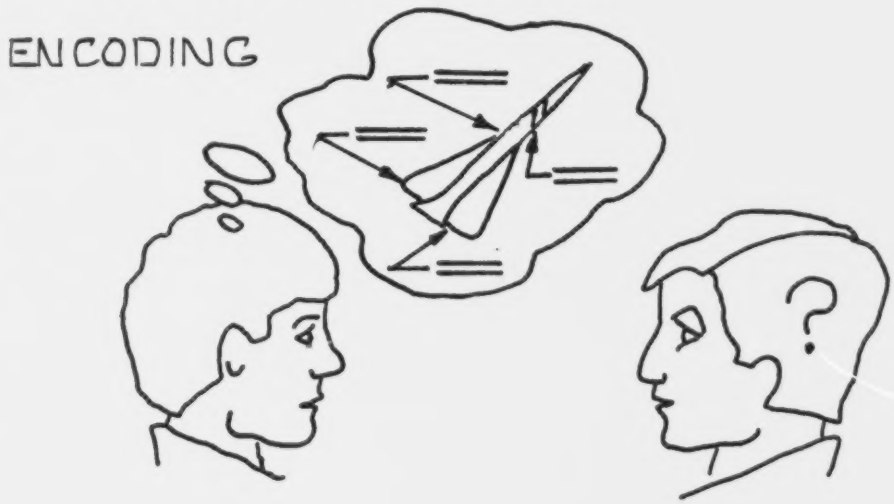
Communication begins with a SENDER. A sender is someone that needs to move information. Unless you like talking to yourself, you will also need a RECEIVER. In our example, the person who will help build the rocket is the receiver.



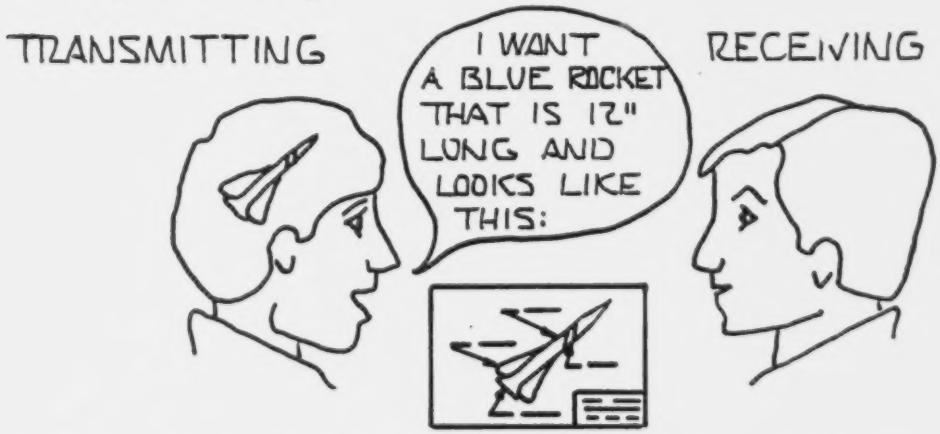
SENDER

RECEIVER

Since the receiver cannot read your mind, you will have to tell and show the receiver what you want the rocket to look like. In order to help the receiver understand what you want, you will need to pick the best combination of words and pictures to help the receiver understand what you want. This process is called ENCODING.

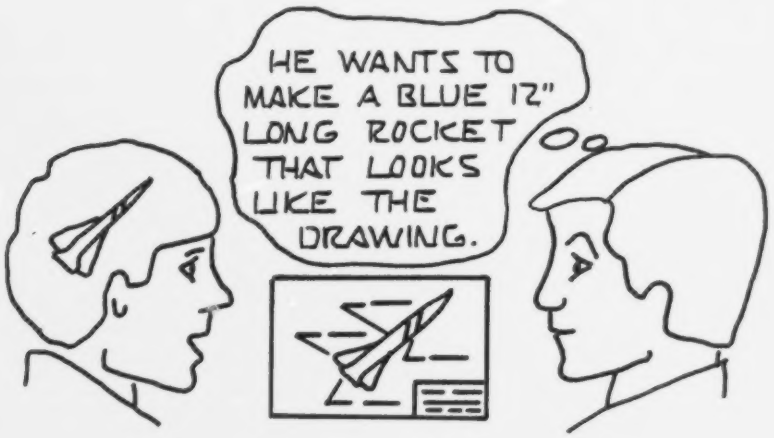


Once you know how to put the information into a form that the receiver can understand, you need to send the message. The process of sending the message is called TRANSMITTING. You can transmit information by talking, writing or drawing.



In order for your helper to understand what you want, he or she must receive the message you transmitted. Your helper must listen to what you are saying and look at your drawing. This is called RECEIVING in the communication process.

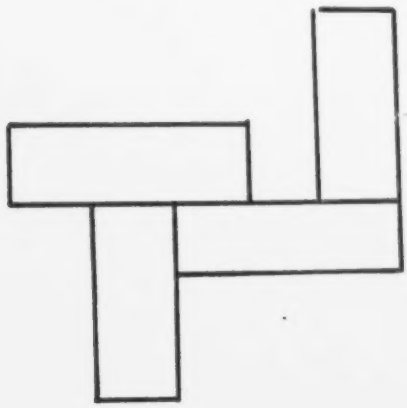
The next step for the receiver is to create a mental picture in his or her own mind. The process worked, the mental picture in your mind is close to the mental picture in your helper's mind. The goal is for the receiver's mental picture to be the same as the sender's.

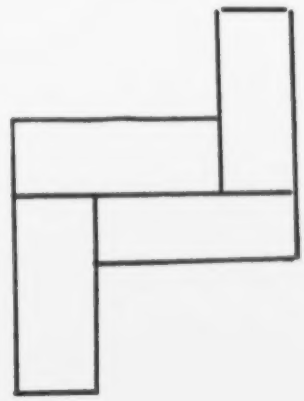


COMMUNICATION PROCESS ACTIVITY

Directions for Round One:

Do not allow your partner to see the images below. Choose one of the two images for this activity. When your instructor tells you it is time to start, try to describe the image to your partner a little at a time. Your partner will try to draw the image from your description. Hint: give positions on the page names that you and your partner can use during the communication process (for example: top, right, left, and bottom, or north, south, east, and west).





Directions for Round Two:

Try not to look at your partner's handout; it will spoil the fun. When your instructor tells you it is time for round two, your partner will try to describe an image to you a little at a time. It is now your turn to sketch the image from your partner's description in the space below.

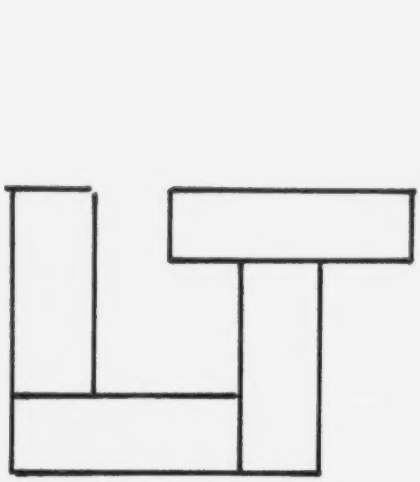
COMMUNICATION PROCESS ACTIVITY

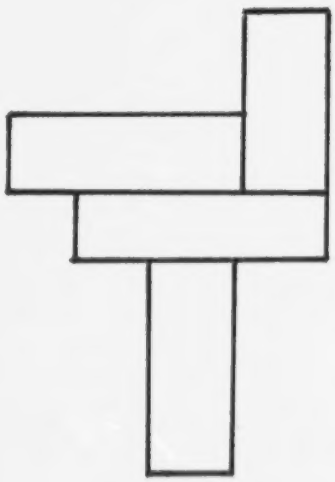
Directions for Round One:

Try not to look at your partner's handout; it will spoil the fun. When your instructor tells you it is time to start, your partner will try to describe an image to you a little at a time. Sketch the image in the space below from your partner's description. Hint; give positions on the page names that you and your partner can use during the communication process (for example: top, right, left, and bottom, or north, south, east, and west).

Directions for Round Two:

Do not allow your partner to see the images below. Choose one of the two images for this activity. When your instructor tells you it is time for round two, try to describe the image to your partner a little at a time. This time, your partner will be trying to draw an image from your description.





UNIT: Using the Language of Industry

LESSON 2: Sketching One View Drawings

Objectives	Lesson Content	Learning Activities	Ref.
A. Following a discussion, students will be able to: -explain why sketiching is a valuable communication tool. -identify the basic rules of sketching. -identify examples of the two basic resources needed to communicate through sketching.	A. Basic Sketching 1. Communication Value a. sketching enables one to visualize, store, compare, and communicate ideas b. sketching can help you think clearly, solve problems, and break down language barriers c. sketching does not require fancy drafting tools, computers or electricity. 2. Communicating Through Sketching Requires: a. a tool to make marks (pencil, stick, chalk) b. a surface to record marks (paper, sand, or chalk board) 3. The Basic Rules for Sketching a. sit in a relaxed and upright position. b. hold your pencil near the point	A. Teacher Guided Discussion 1. Ask a student to perform a task that requires a sketch to communicate effectively 2. Discuss the communication value of sketching and why it is a very valuable skill to have. 3. Discuss the two basic resources needed to communicate through sketching. Have students list examples of resources that can be used to sketch information. 4. Using OT #2-1, discuss the basic rules of sketching. 5. On the chalk board, demonstrate how the rule of sketching are used to develop a sketch of a simple object.	TA #2-1: Sketching One View Drawings OT #2-1: Rule for Sketching

c. position your paper at a natural angle with your arm
d. use arm motions to draw and try to avoid using your wrist or fingers to draw
e. start by lightly sketching the general shape of the object. Save darkening in and drawing details for last.
f. use single strokes to draw lines, circles, arcs, and irregular lines
g. don't be discouraged, sketching will require alot of practice.

B. Following a demonstration, in a lab activity, students will be able to use the defined sketching techniques to copy given illustrations accurately and in good proportion.	B. Using sketching techniques to draw simple objects 1. diskette 2. calculator 3. robot	B. Learning Activity 1. Provide each student with HO #2-1 and make sure each student has paper and a pencil. 2. Have students follow the illustrated steps to sketch the objects assigned. 3. Provide individual instruction as needed. 4. Before the end of the period, provide students with feedback regarding their sketching technique. Collect, evaluate,	HO #2-1: Sketching a One View Drawing

SKETCHING ONE VIEW DRAWING

Introduction:

Find several abstract objects and display them on a bench (for example: small engine parts). Ask a student to get you a "whatcha-ma-call-it." The student will not know what you are talking about and will most likely ask you what a "whatch-ma-call-it" looks like. Use abstract verbal and non-verbal communication to describe the object. Ask another student to get the object. This student will not know what you are talking about either. Continue this process until you want to bring the introduction to a close. Communicate more effectively by sketching the object desired on the chalk board and have a student bring you the object in question.

Discuss the communication value of sketching and why it is a very valuable skill. Include examples of how and when sketching is used in industry. Your examples might include things like brain storming ideas for a new product, discussing a project during a business lunch, and communicating with a builder what a room addition should look like.

Discuss the two basic resources needed to communicate through sketching (a tool to make marks and a surface to record marks). Have students list examples of resources that can be used to sketch information.

Using OT #2-1, discuss the basic rules of sketching. Explain why each rule is important. Emphasize the concept that sketches evolve from simple to detailed, from light to dark, and from rough to refined. On the chalk board, demonstrate how a sketch evolves by drawing a simple one view object. Stress the need to practice and make sure students understand their first sketches will not be master pieces.

Learning Activity:

Provide each student with HO #4-1 and make sure each student has paper and a pencil. Your students will be more successful if they draw their sketches on graph paper or put graph paper under the plain paper as a guide. Explain how to follow the illustrated steps provided on the lab sheet. Have students begin sketching. Circulate around the class room and provide individual instruction as needed. Students will probably resist following the rules of sketching and will need to be encouraged to give them a try. Before the end of class, tell students how they are doing as a group and make whatever general recommendations are necessary. Try to keep your feedback as positive as possible. Collect the sketchs at the end of the class period. Evaluate the

sketches in terms of their communication value more than accuracy and neatness. When the drawings are returned, allow students to further refine their sketches on their own time and turn them in for a second evaluation. You may want to display all or some of the sketches.

SKETCHING A ONE VIEW DRAWING

Introduction:

Ideas are often simple sketches on paper long before they get to a draftperson's table or computer. The ability to sketch can enable you to quickly visualize, store, compare, and communicate your ideas. Sketching can help you think clearly, solve problems, and give your ideas to others. Sketching does not require fancy drafting tools, computers or electricity. All you need to help people understand your ideas is a tool to make marks and a surface to record marks (for example: pencil and paper, stick and sand, or chalk board).

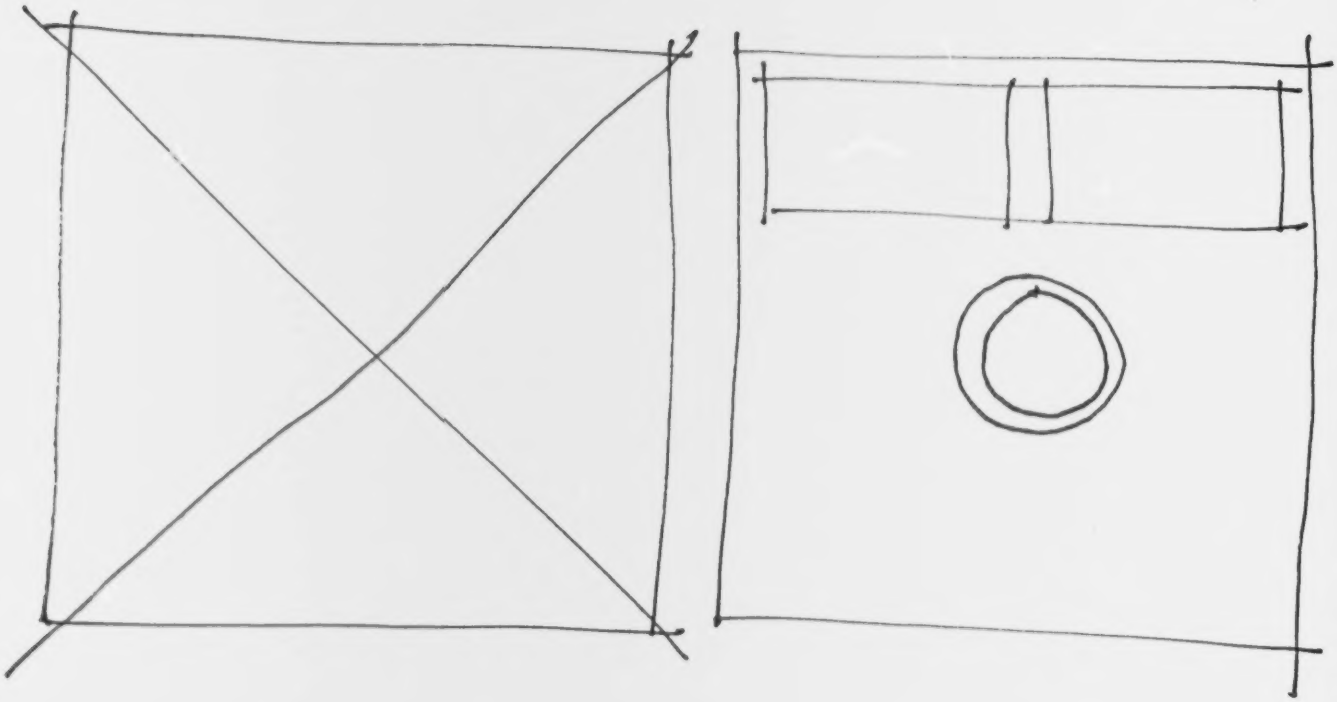
The Basic Rule for Sketching:

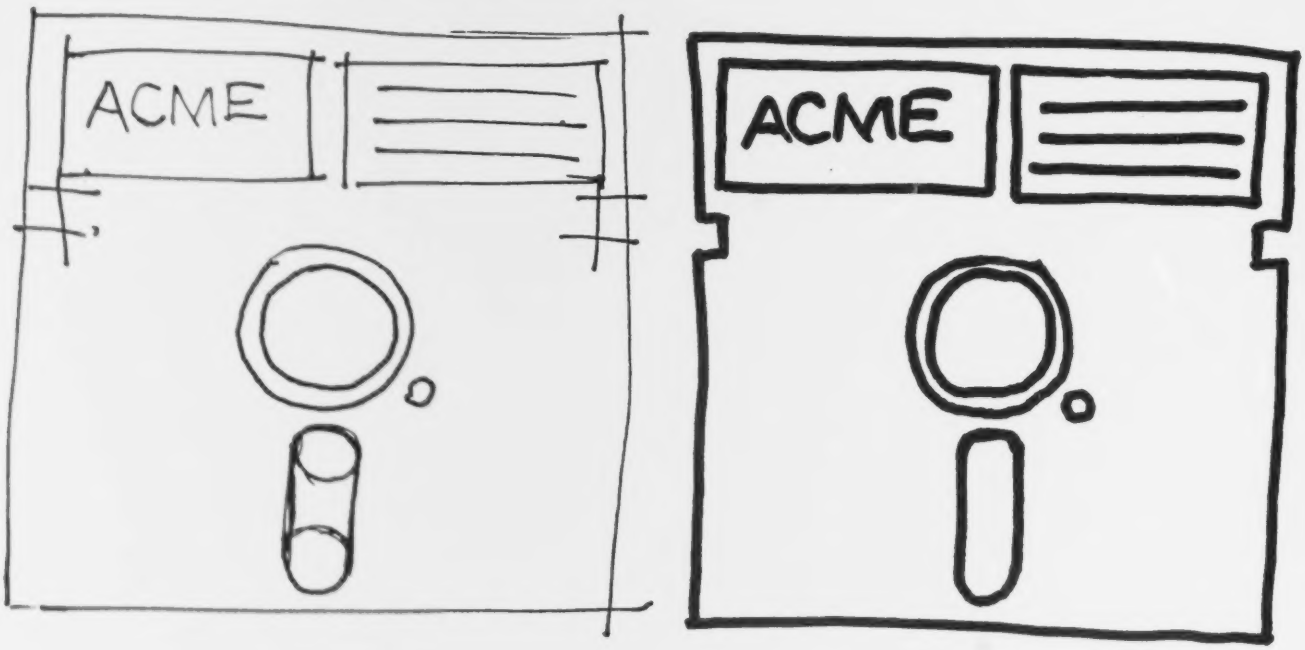
Learning to sketch is like any other skill, you need to practice. Sketching can be easier to learn and you will be more successful if you follow some simple rules.

1. Sit in a relaxed and upright position.
2. Hold your pencil near the point.
3. Position your paper at a natural angle with your arm.
4. Use arm motions to draw and try to avoid using only your wrist or fingers to draw.
5. Start by lightly sketching the general shape of the object. Save darkening in and drawing details for last.
6. Use single strokes to draw lines, circles, arcs, and irregular lines.
7. Don't be discouraged, sketching well takes practice.

Directions:

You are to sketch the following objects by following the steps illustrated. Remember to use the basic rules for sketching.

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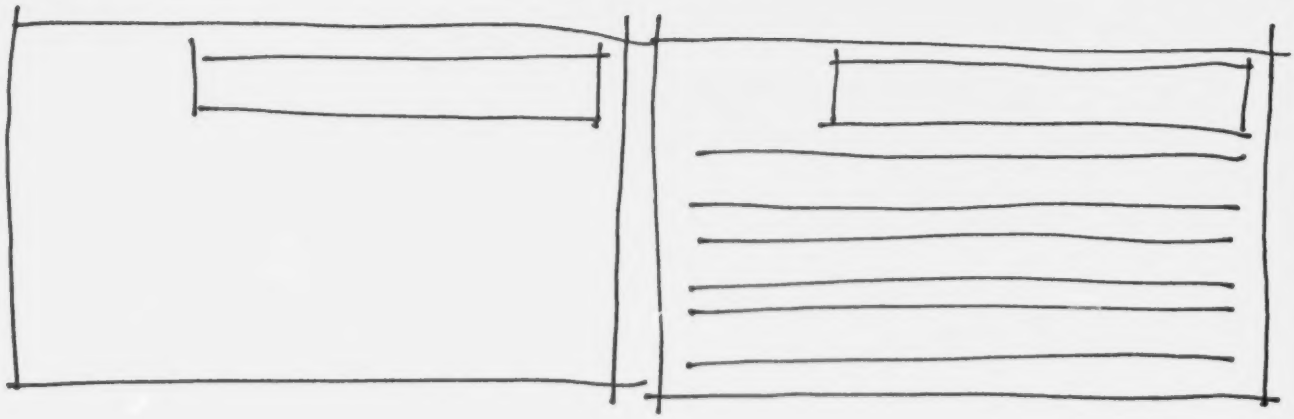

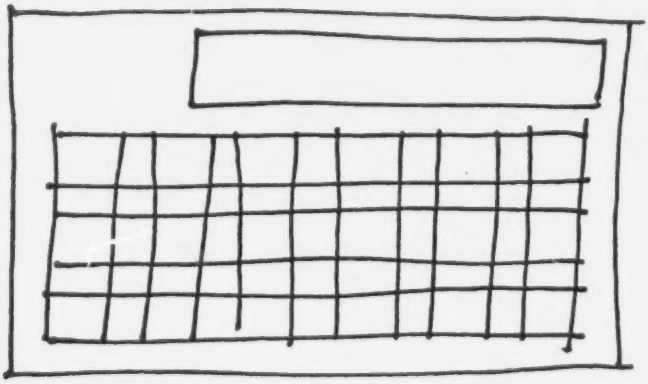

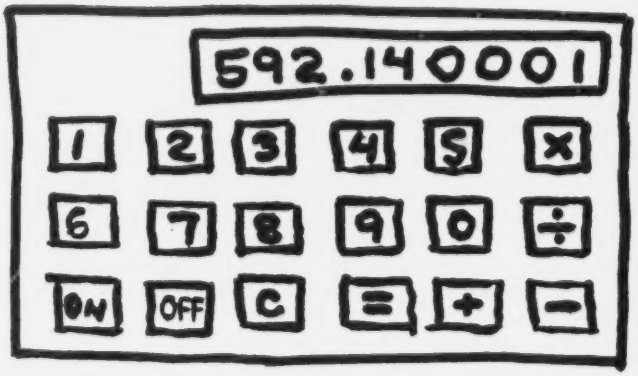
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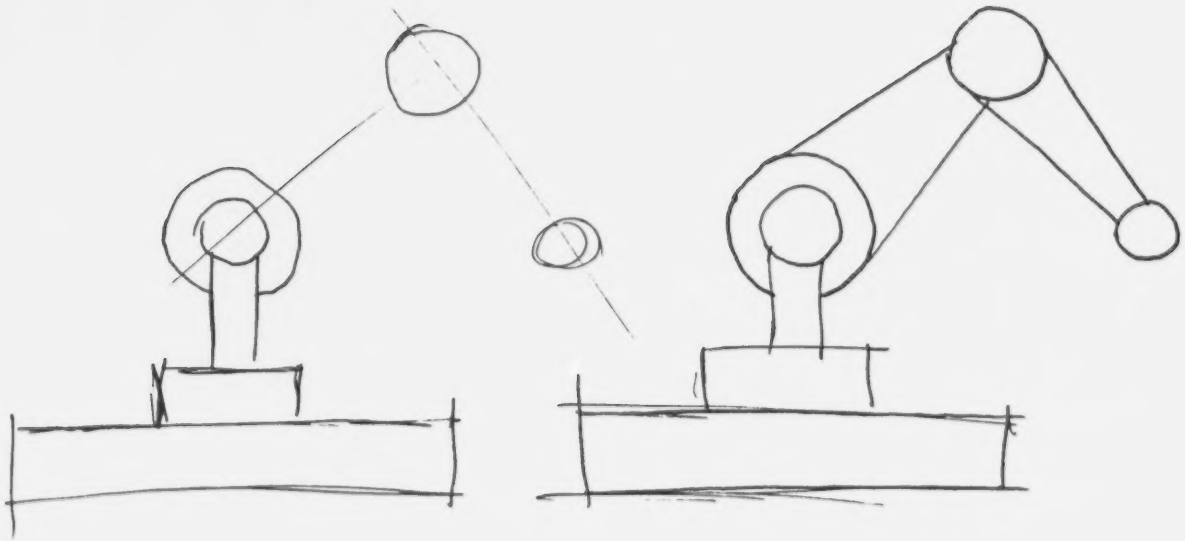
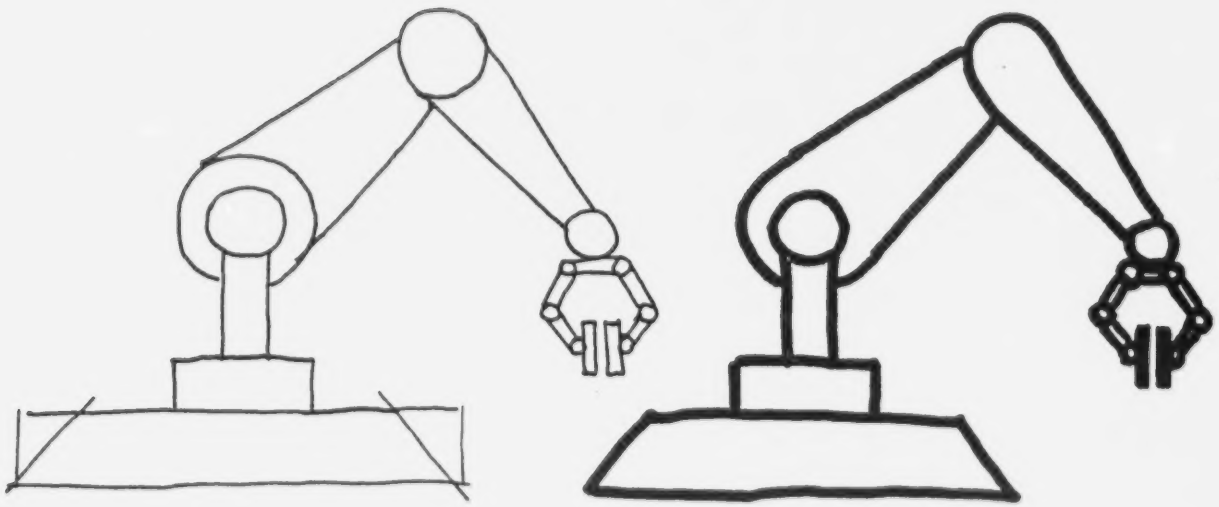




RULES FOR SKETCHING:

1. Sit up upright and relaxed
2. Hold your pencil near the point
3. Position your paper at a natural angle with your arm.
4. Use arm motions to draw. Avoid using your wrist or fingers to draw.

5. Lightly sketch the general shape of the object first. Save darkening in and drawing details for last.
6. Use single strokes to draw lines, arcs, and circles.
7. Don't be discouraged, sketching well requires practice.

UNIT: Using the Language of Industry

LESSON 3: Sketching Pictorial Drawings

Objectives	Lesson Content	Learning Activities	Ref.
A. Following a discussion, students will be able to: -identify an advantage and disadvantage of a pictorial drawing. -list four industrial applications for pictorial drawings. -identify the four basic shapes used to develop pictorial sketches.	A. Pictorial Drawings 1. Pictorial drawings are life like representations that include two or more sides of the object. 2. Advantage: Pictorial drawings are easy to understand. 3. Disadvantage: It is difficult to include technical details in pictorial drawing. 4. Applications: a. advertising and selling products b. instructions for consumers c. service manuals d. presenting designs for products 5. The four basic shapes used in drawing a. cube b. cone c. cylinder d. circle	A. Teacher Guided Discussion 1. Using OT #3-1, have students identify the drawing that is easiest to understand. 2. Discuss the advantage and disadvantage to pictorial drawing. 3. Ask students where they have seen pictorial drawings and list them on the chalk board. 4. Discuss the industrial applications for pictorial drawing. 5. Using OT #3-1, discuss the four basic shapes used to develop a pictorial drawing. 6. On the chalk board, demonstrate how to develop a pictorial drawing of a simple object from a combination of basic shapes. 7. Review the basic rules of sketching.	TA #3-1: Sketching Pictorial Drawings OT #3-1: Differe Types of Drawing OT #3-1: Basic Shapes

B. Following a demonstration, in a lab activity, students will be able to: -identify the basic shapes that make up the skeleton of given objects -rough in the basic shapes needed to draw a pictorial view of a given object. -develop a sketch from its basic skeleton to a refined pictorial representation of a given object.	B. Sketching Pictorial Drawings 1. Stereo 2. Computer 3. Cabin 4. Racing Car	B. Learning Activity 1. Provide each student with HO #3-1 and make sure each student has paper and a pencil. 2. Have students follow the illustrated steps to sketch the objects assigned. 3. Provide individual instruction as needed. 4. Before the end of the period provide students with feedback regarding their sketching techniques. Collect, evaluate, and/or display the sketches.	HO #3-1: Sketching Pictorial

SKETCHING PICTORIAL DRAWINGS

Introduction:

Display several different types of drawings. Include a floor plan, schematic, pictorial drawing, and an orthographic projection. Ask students which of the drawings is the easiest to understand. Hopefully, most of the students will identify the pictorial drawing as being the easiest to understand. Ask students what advantage do pictorial drawings have over the other types of drawings (floor plans, schematics, and multiview drawings). Discuss why their "life like" quality makes them a valuable communication tool in industry. Have students identify where they have seen or used pictorial drawings. List them on the chalk board. Discuss where in industry pictorial drawings are used. In your discussion make sure to include architectural, marketing, research and development, and servicing applications.

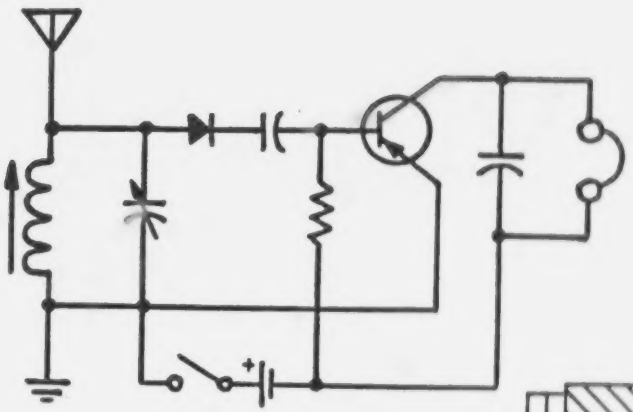
How to Sketch Pictorial Drawings:

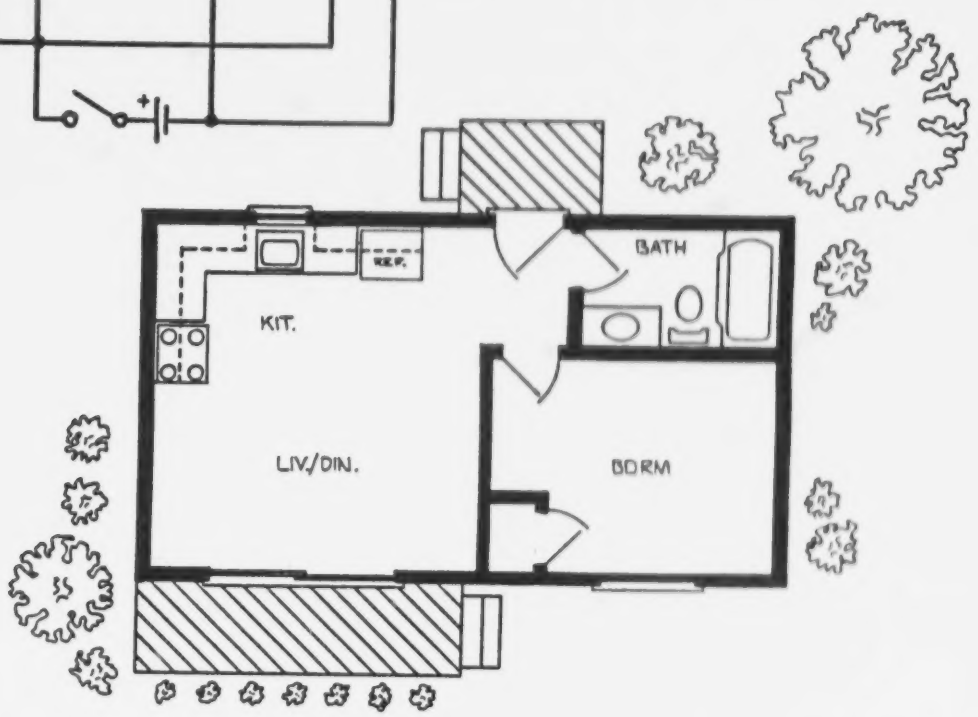
Explain why the secret to sketching pictorial drawings is to learn to see the basic shapes that make up the skeleton of the object in question. Illustrate the four basic shapes used to develop a pictorial drawing. On the chalk board, demonstrate how to develop a pictorial drawing of simple objects from a combination of basic shapes. For example, draw a rocket from cylinders and cones and/or a two story house from a combination of cubes. Stress the importance of the evolutional process, from rough to refined, from simple to complex, and from light to dark. Review the basic rules for sketching.

Learning Activity:

Provide each student with HO #3-1 and make sure each student has paper and a pencil. Your students will be more successful if they draw their sketches on isometric graph paper or put isometric graph paper under the plain paper as a guide. Explain how to follow the illustrated steps provided on the lab sheet. Have students begin sketching. Circulate around the class room and provide individual instruction as needed. Students will probably still be resisting the rules of sketching. You will need to encourage students to correct their techniques if it is preventing them from being successful. Before the end of class tell students how they are doing as a group and make whatever general recommendations are necessary. Try to keep your feedback as positive as possible. Collect the sketches at the end of the class period. Evaluate the sketches in terms

of their communication value. Try not to put too much emphasis on details that do not compromise basic communication. When the drawings are returned, allow students to further refine their sketches on their own time and turn them in for a second evaluation. You may want to display all or some of the pictorial sketches.

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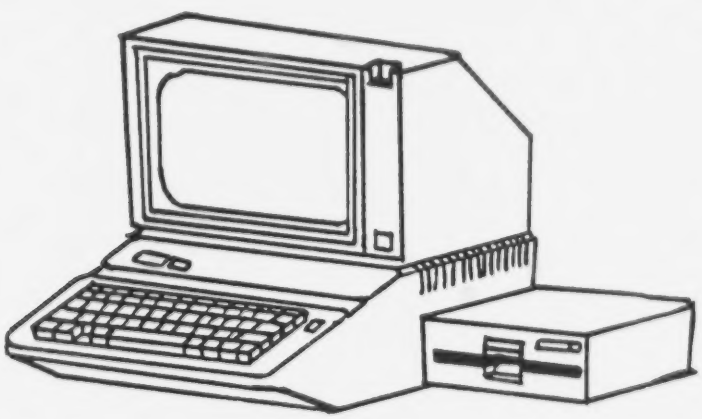

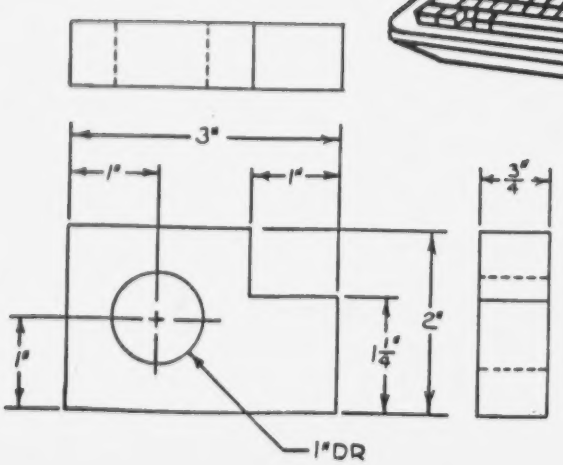
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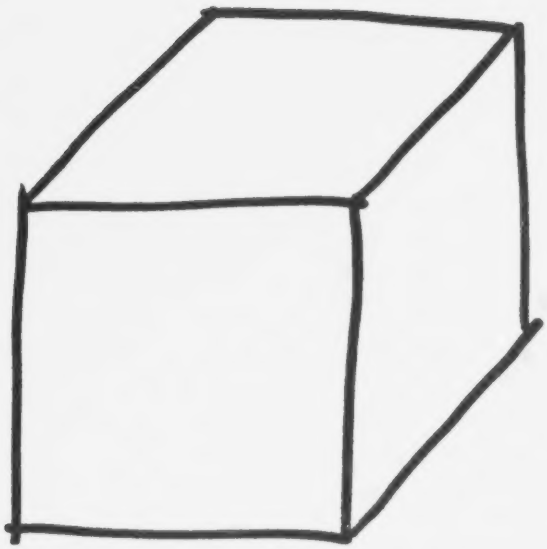
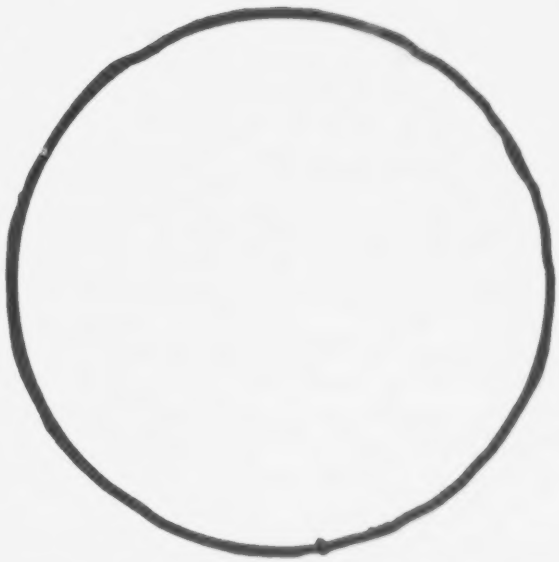
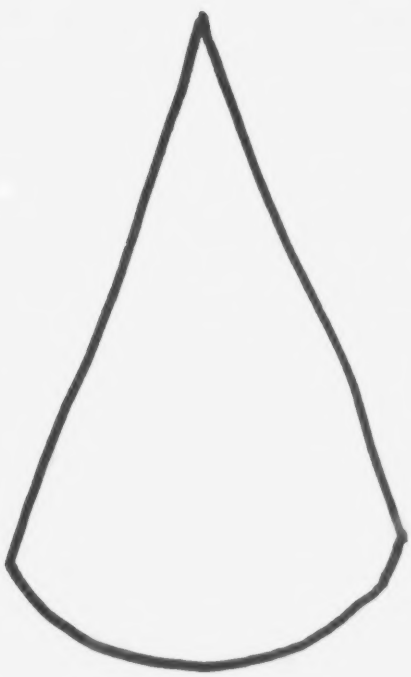
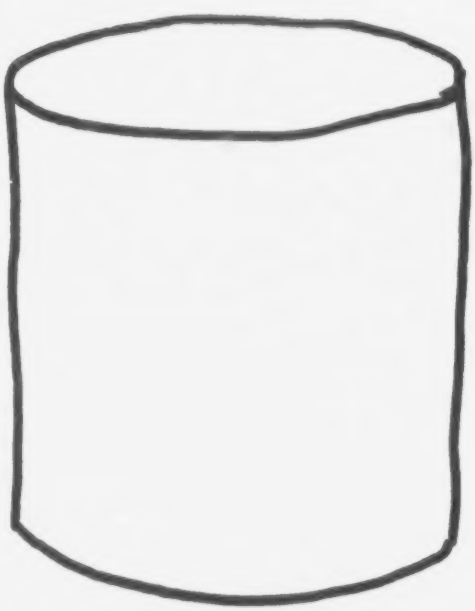








SKETCHING PICTORIAL DRAWINGS

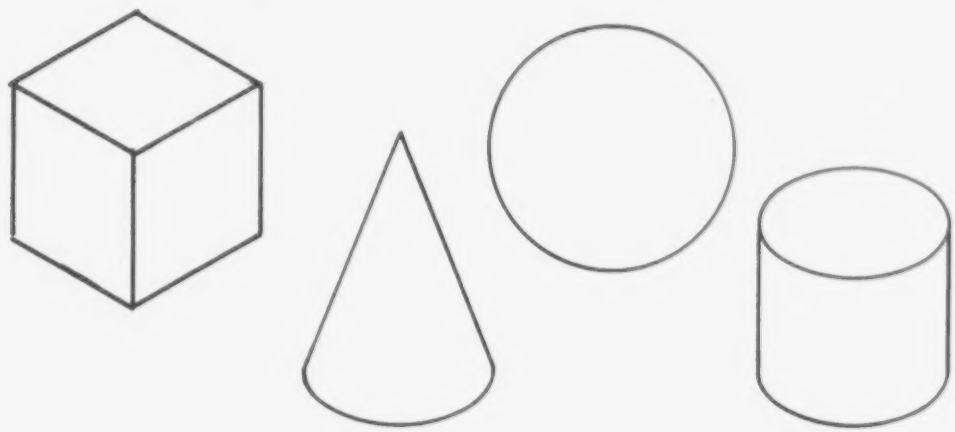
Introduction:

As the saying goes, "a picture is worth a thousand words." A pictorial drawing shows two or more sides of the object in one image. Since the object looks real, pictorial drawings are easy for people to understand. In industry, they are powerful communication tools. Pictorial drawings are used when it is important to know how something will look before it is made. Architects use pictorial drawings to show their customers what their houses will look like. Designers use pictorial drawings to communicate their new product design ideas. Managers will look at several drawings before deciding which design idea is the best. Marketing people often use pictorial drawings to advertise and sell products. The people who repair new products often need to refer to pictorial drawings in service manuals. When you purchase a new product that requires assembly, the instructions are often based on pictorial drawings. Unfortunately, pictorial drawings are not very useful when you are trying to communicate a lot of details and measurements. When it is time to make a product, other types of drawings are often used in addition to pictorial drawings.

How to Sketch Pictorial Drawings:

Just like the one view drawings, you start with the object's general shape. The general shape of an object can be broken down into one or more of the four basic shapes. These four basic shapes are a cube, cone, circle, and cylinder. By using a combination of these shapes, you can draw the general shape of any object.

ILLUSTRATIONS



Before trying to sketch an object, first study its mass and determine its basic shape or shapes. Sketch the basic shape or shapes on your paper.

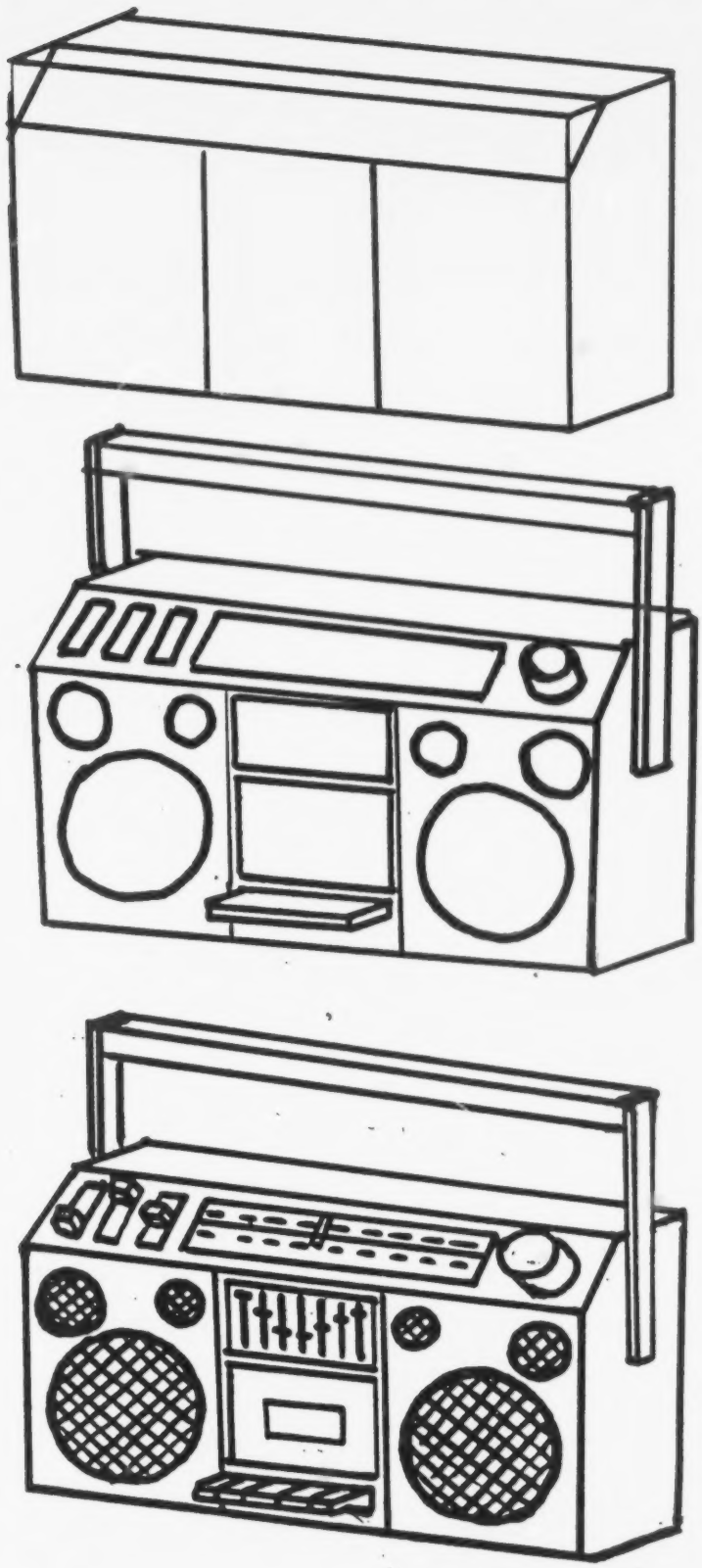
After you have laid out an object's basic shape, you can start modifying it to look more like the subject a little at a time. It is important to remember that drawings evolve from rough to refined and from light to dark. Draw the large details first. Try to keep the lines light. Light lines are easier to erase.

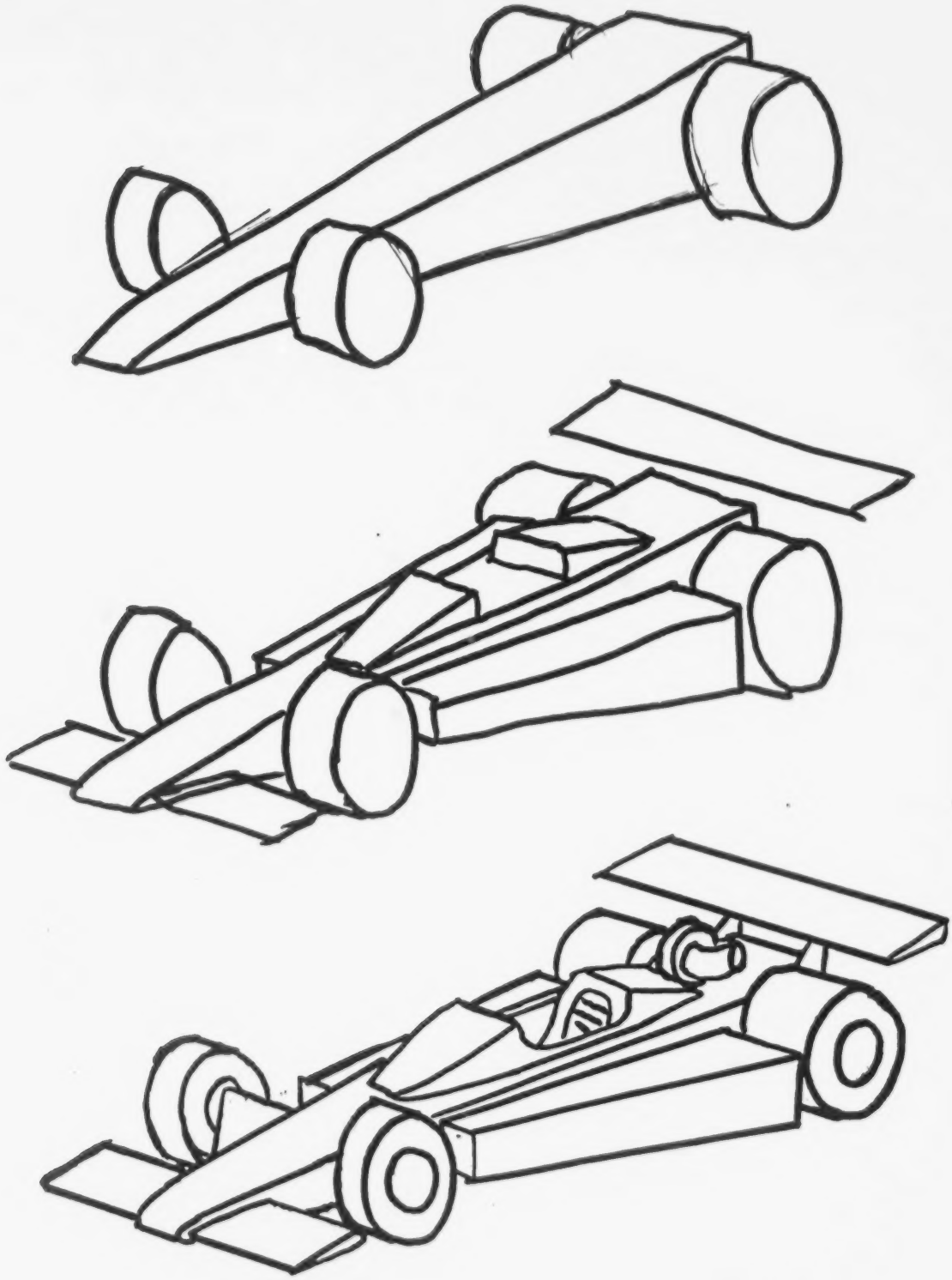
Once the large details have been drawn, start adding the smaller details. The last step in the sketch process is to refine your drawing. During this step, you will touch-up your drawing, erase unwanted lines, and darken in the lines you want to emphasize. Once again, don't be discouraged. Being able to sketch well requires lots of practice.

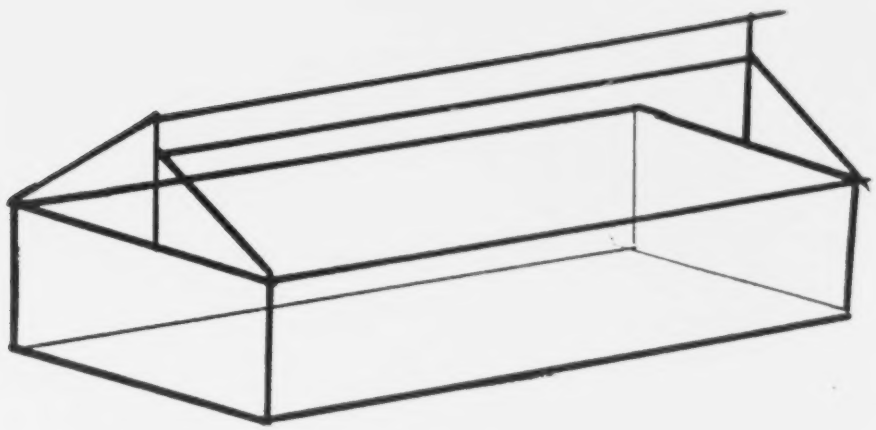
Directions:

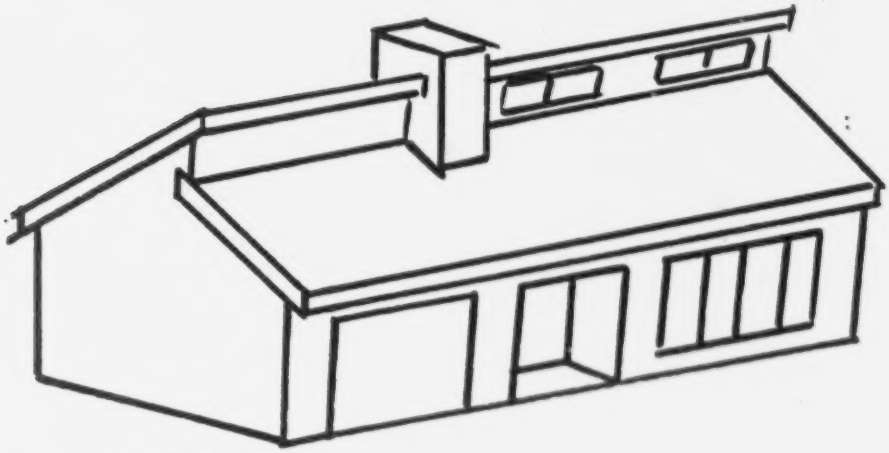
You are to sketch the following objects by following the steps illustrated. Remember to use the basic rules for sketching.

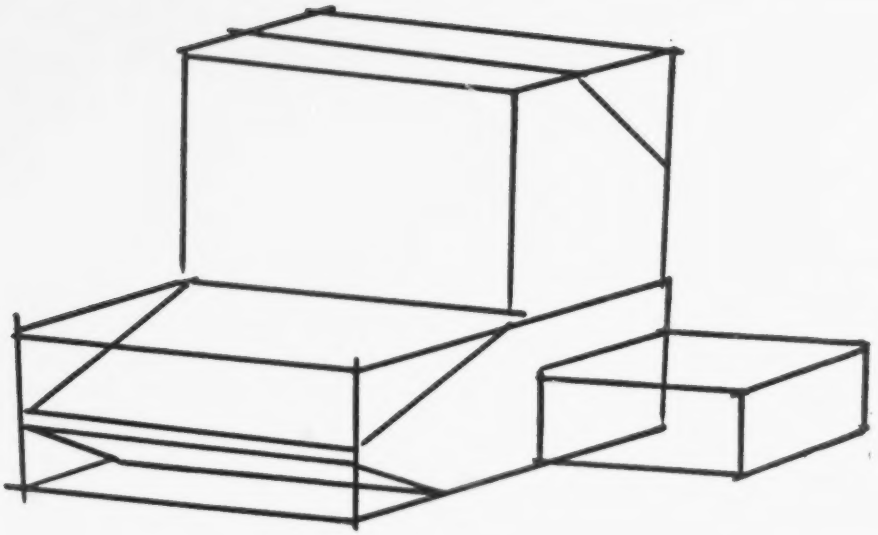
1. Sit in a relaxed and upright position.
2. Hold your pencil near the point.
3. Position your paper at a natural angle with your arm.
4. Use arm motions to draw and try to avoid using only your wrist or fingers to draw.
5. Start by lightly sketching the general shape of the object. Save darkening in and drawing details for last.
6. Use single strokes to draw lines, circles, arcs, and irregular lines.
7. Don't be discouraged, sketching well takes practice.

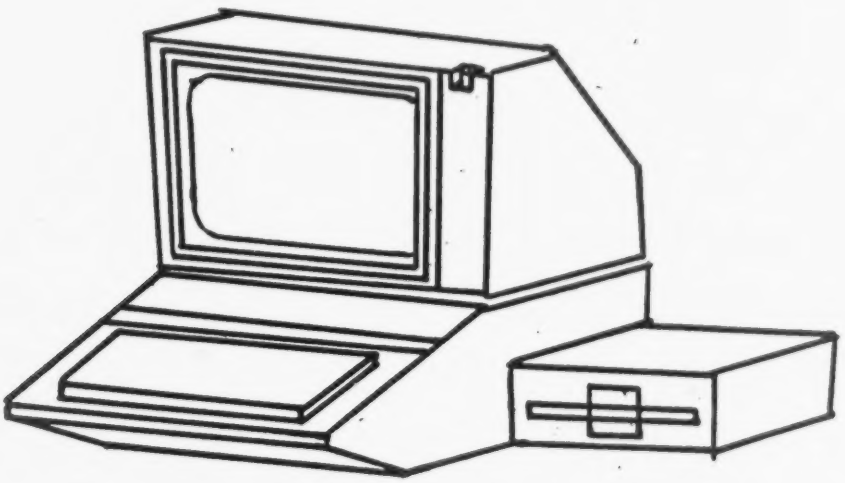


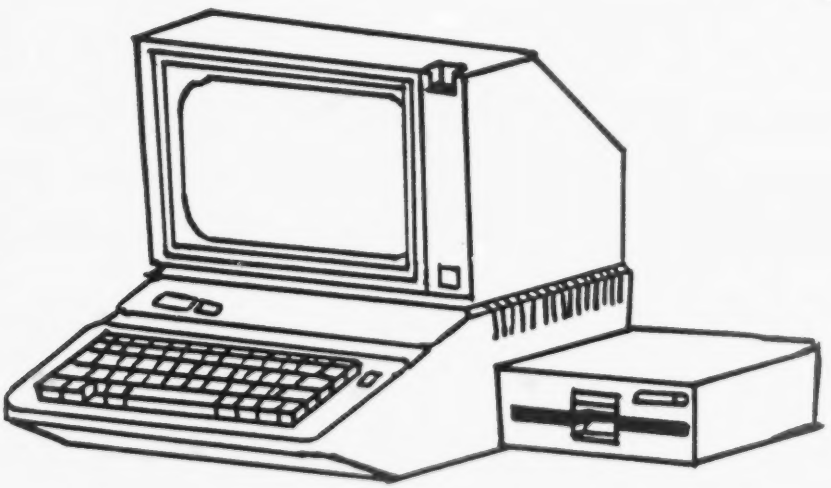












UNIT: Using the Language of Industry

LESSON 4: Sketching Multiview Drawings

Objectives	Lesson Content	Learning Activities	Ref.
A. Following a discussion, students will be able to identify: -the views in a multiview drawing -appropriate applications for multiview drawings. -object, hidden, center, extension, and dimension lines on a given drawing. -the correct placement and order for given dimensions.	A. Multiview Drawings 1. Multiview drawings communicate: a. through separate views (top, front, right side, etc.) b. the size, shape and details of an object 2. Basic views a. top view b. front view c. right side view 3. Basic lines a. object lines b. hidden lines c. center lines d. extension and dimension lines 4. Dimensioning rules a. dimensions are located between views when possible b. dimension the view that shows the shape best c. place smaller detailed dimensions inside and closer to the object than overall dimensions d. dimension a hole by giving its diameter using a leader. e. do not repeat dimensions	A. Teacher Guided Discussion 1. Using the chalk board, discuss and demonstrate how to draw a multiview drawing of a text book. Have your students follow the discussion using their textbook as a guide. 2. Ask students what kinds of information could be communicated in each view. 3. Using OT #4-1, discuss the communication role of each type of line in the drawing 4. Using OT #4-1, explain the basic rules for dimensioning a drawing. 5. Review the basic rules of sketching if needed.	TA #4-1: Sketching Multiview Drawings OT #4-1: Multiview Drawing

B. Following a demonstration, in a lab, from a three dimensional mock-up, students will be able to: -layout the views needed to communicate -record the object's features in all the views using the correct symbols -dimension and document a drawing so the object could be produced without additional forms of communication.	B. Sketching Multiview Drawings 1. mock-up analysis 2. layout views 3. draw the features of the object in each view 4. dimension the object 5. darken in the drawing	B. Learning Activity 1. Provide each students with HO #4-1 and a mock-up. 2. Have students sketch a multiview drawing of their assigned mock-up. 3. Provide individual instruction as needed. 4. Before the end of the period, provide students with feedback regarding their sketching technique, use of lines, and dimensioning. 5. Collect, evaluate, and/or display the sketches.	HO #4-1: Sketch Multiview Drawings

SKETCHING MULTIVIEW DRAWINGS

Preparation:

Orthographic projection can be a very abstract and difficult concept for the junior high school students to understand. Students can learn the concept of views easier and be more successful with their drawings if they can work from a mock-up. With the aid of a mock-up, the encoding process becomes less abstract and more concrete. Mock-ups provide the student with a three dimensional medium that can be rotated for visualizing each view. In addition, if the mock-ups are drawn full scale, you and your students can make accurate comparisons between their mock-ups and their drawings.

In terms of how drafting is done in industry, the use of a mock-up is very appropriate. Engineers and designers often develop working drawings with the aid of mock-ups and/or prototypes.

Since a very short period of time is dedicated to multiview drawing, it is highly recommended that mock-ups be made by the teacher prior to instruction. The mock-ups can be made out of wood. Cut 3/4" stock into 3" x 2" rectangles. There should be one rectangle per student for your largest class. Modify each rectangle to include two distinct features (dado, taper, bevel, rounded edge, and/or a hole). Keep the mock-ups simple. Refer to the examples provided in this section. Remember, the nature of this unit is exploration and your primary goal is to develop a better thinker through the language of industry.

Introduction:

Introducing students to the concept of views can be done through something simple and concrete, like a text book. Have your students hold a text book in front of them so all they can see is the front cover. Based on the front view, have students tell you about their text book (height, width, graphics, etc.). Draw a front view on the chalk board based on the information provided. Ask the students what they do not know about their book based on the front view (thickness). Tell your students there is a need to look at the book from a different view. Have students hold their books so all they see is the top view. Have students describe their book based on the top view (the edge of the binding, thickness of the text, edges of the pages, thickness of the covers, etc.) Illustrate their description on

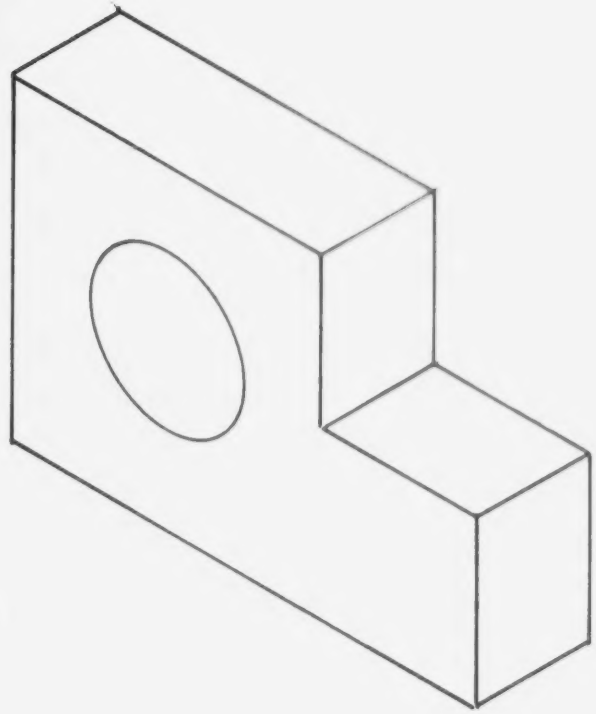
the chalk board. Discuss the dimensions that are different (thickness) and those that are the same (width). Explain the drafting relationship between the two views (projection). Continue this process with the right side, left side, bottom and back view of the text if needed. In a quick review, explain how multiview drawings communicate through separate views. Discuss why multiview drawings are often used when size, shape and details need to be communicated clearly.

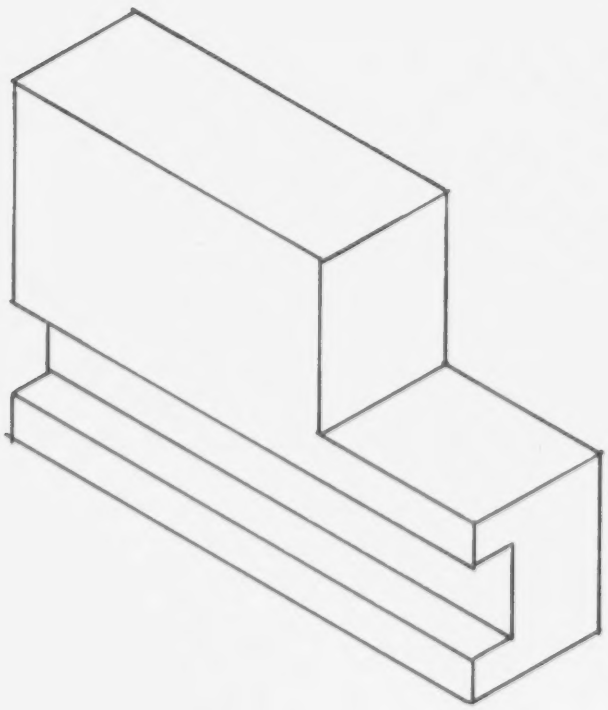
How to Sketch a Multiview Drawing:

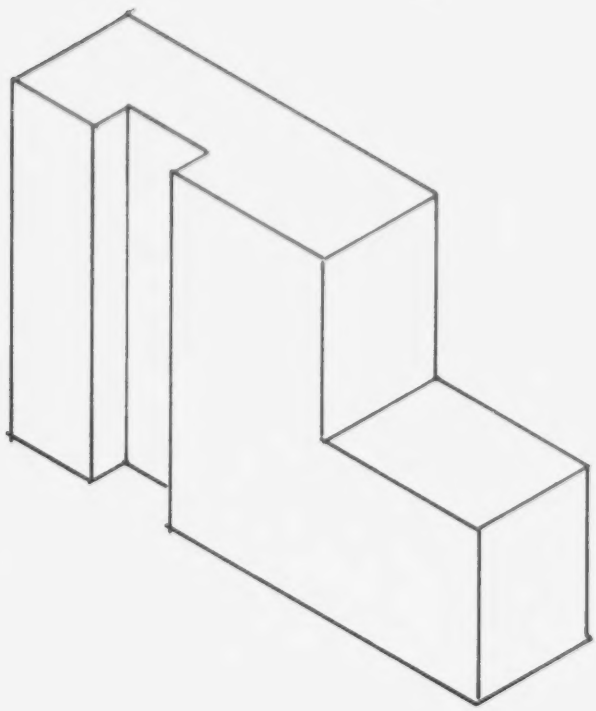
Using OT #4-1, identify the basic types of lines used in multiview drawings. Discuss the communication role of each line and the rules used to dimension a drawing. Identify how the rules apply to the drawing on OT #4-1. Refer to the specific rules that will apply to their learning activity. Demonstrate how all the views are developed, feature by feature, and how information can be projected from one view to another. Include in your demonstration the four stages of development, mock-up analysis, laying out the views, drawing the features in each view, dimensioning the drawing, and darkening in the drawing.

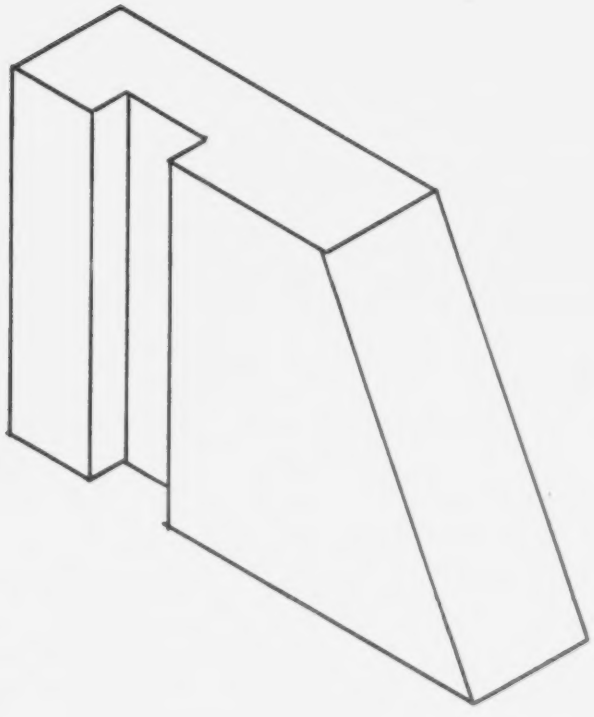
Learning Activity:

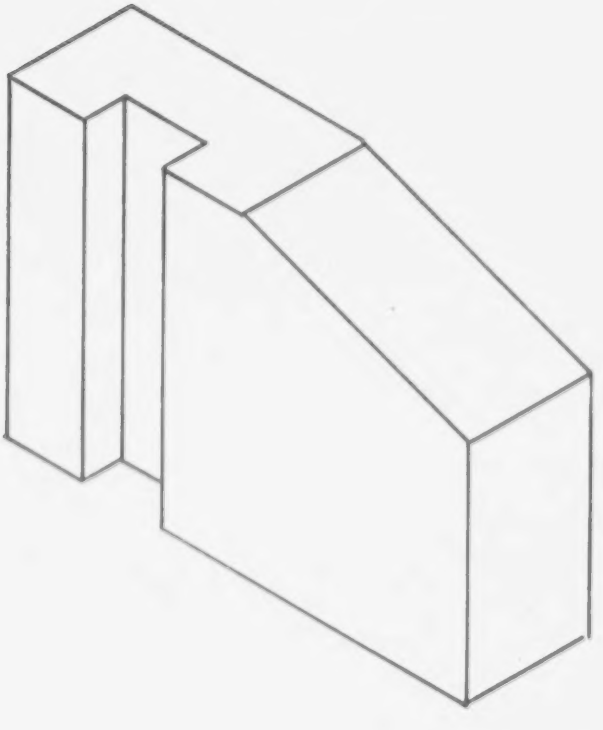
Provide each student with HO #4-1 and a mock-up. Make sure each student has paper and a pencil. Your students will be more successful if they draw their sketches on graph paper or put a piece of graph paper under the plain paper as a guide. Explain how to use the corner marks to locate each view on the lab sheet. Since one of the activity goals is to experience the relationship between the views, you may want your student to use a straight edge to lay out and draw their lines. Have students begin drawing. Circulate around the classroom and provide individual instruction as needed. Some of your students will resist using elements that are common between the views to develop their drawings. You may want to reinforce the advantages of projecting information from one view to another. Before the end of class, tell students how they are doing as a group and make whatever general recommendations are necessary. Try to keep your feedback as positive as possible. Collect the drawings at the end of the class period. Evaluate the drawings in terms of their communication value. Try not to put too much emphasis on details that do not compromise basic communication. When the drawings are returned, allow students to correct their drawings on their own time and turn them in for a second evaluation. You may want to display all or some of the multiview drawings.

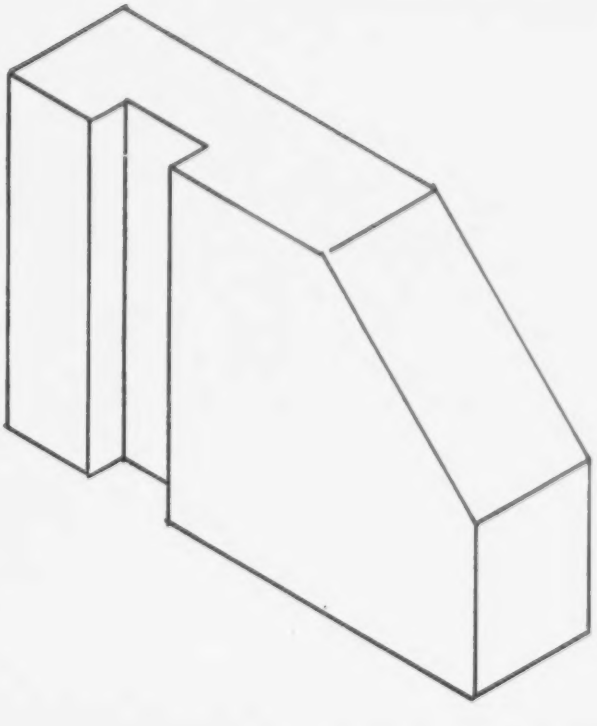


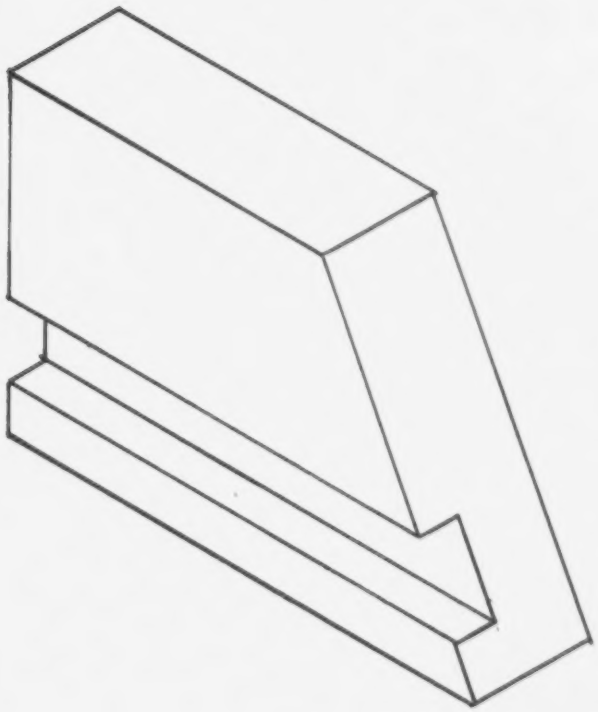


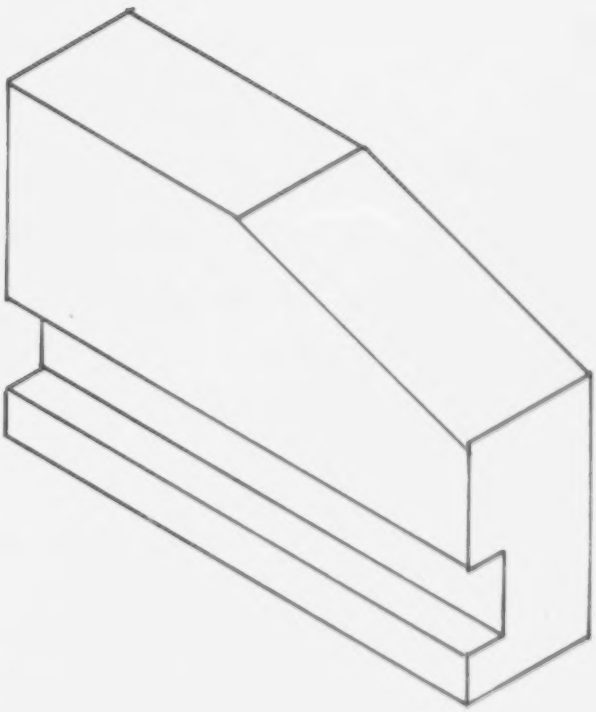


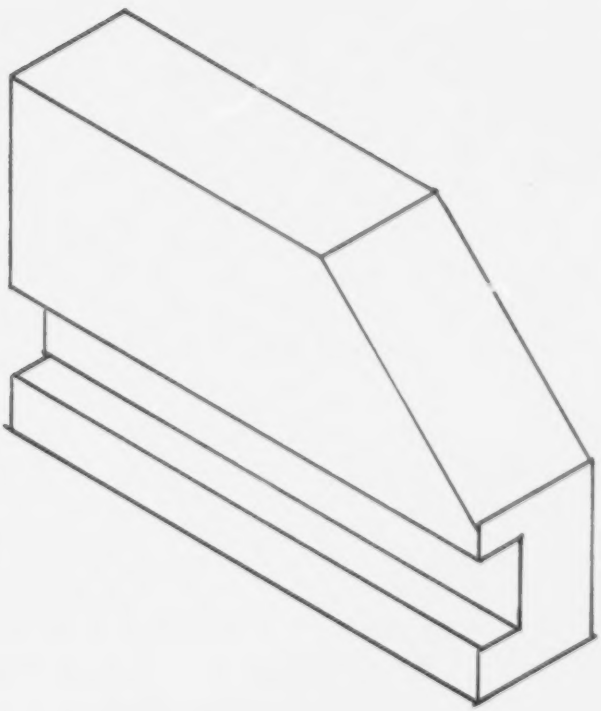


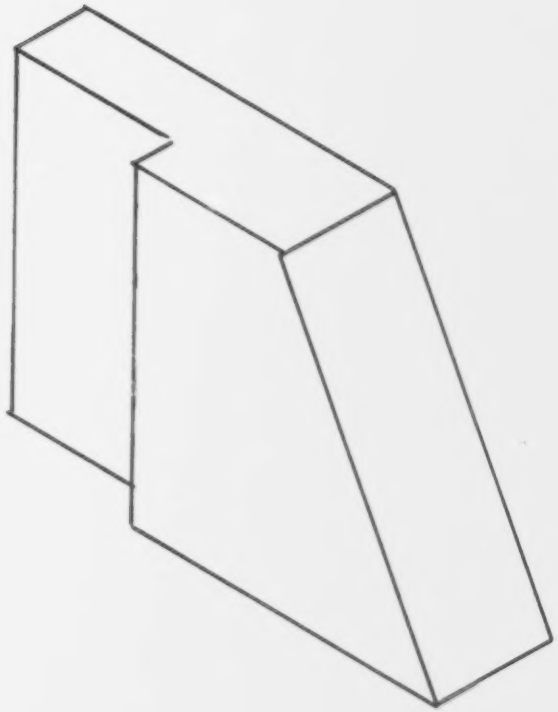


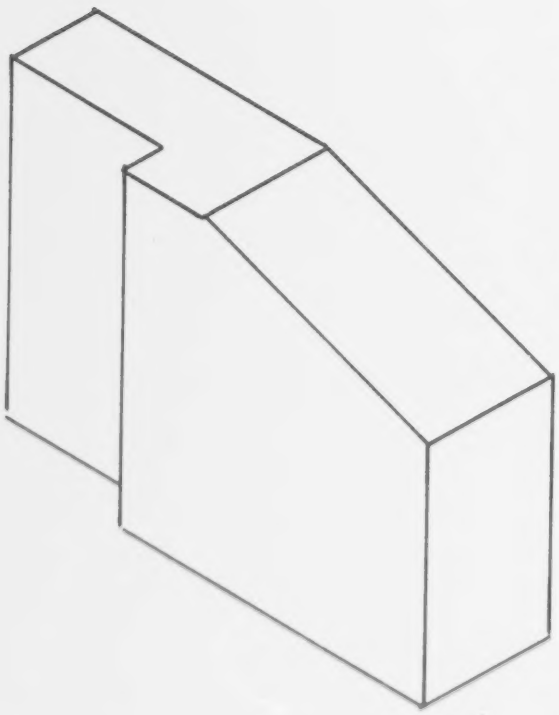


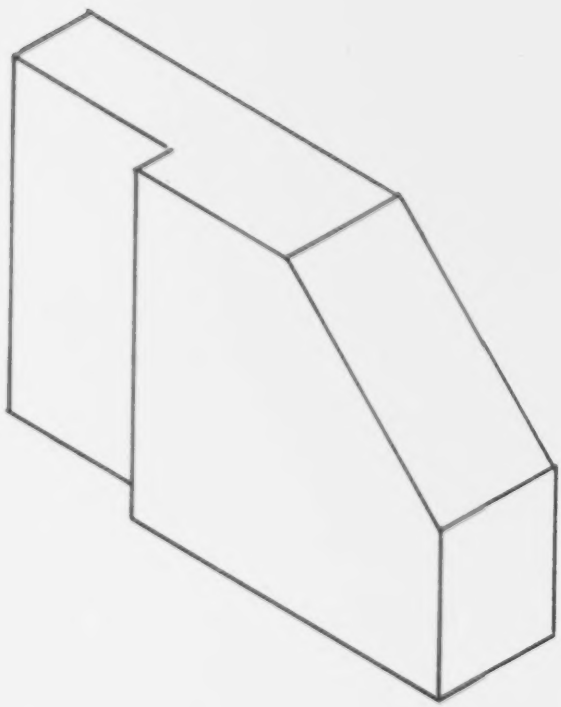


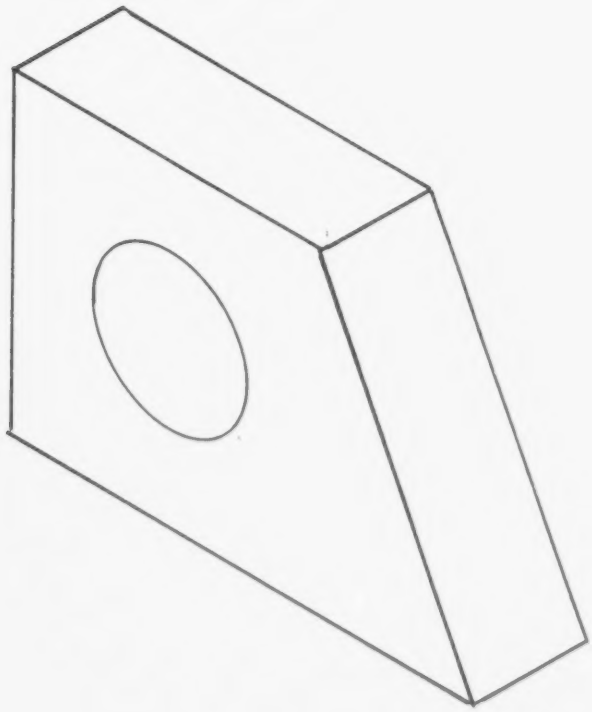


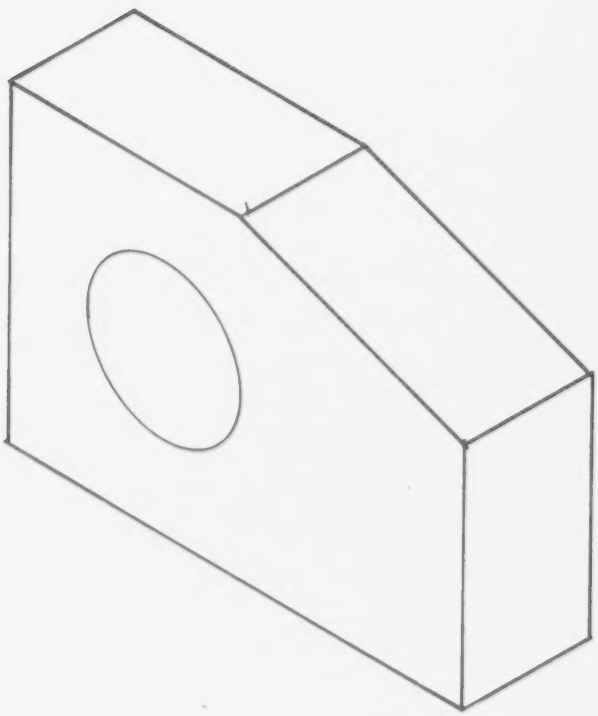


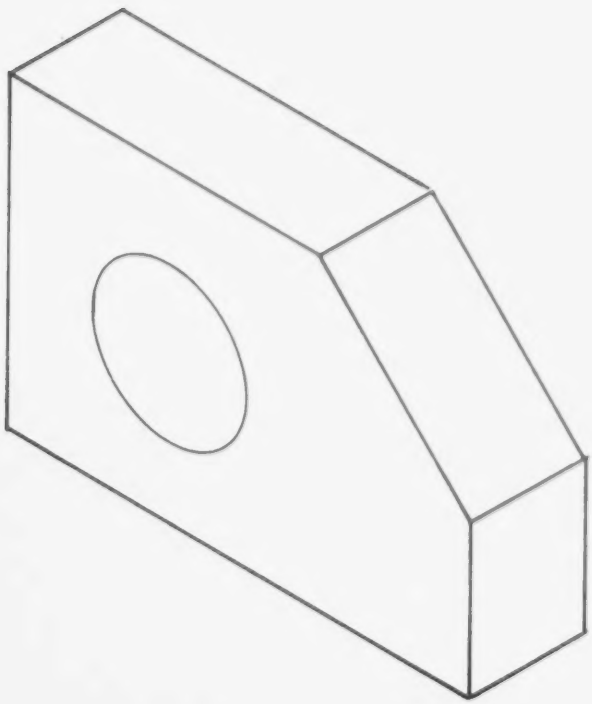


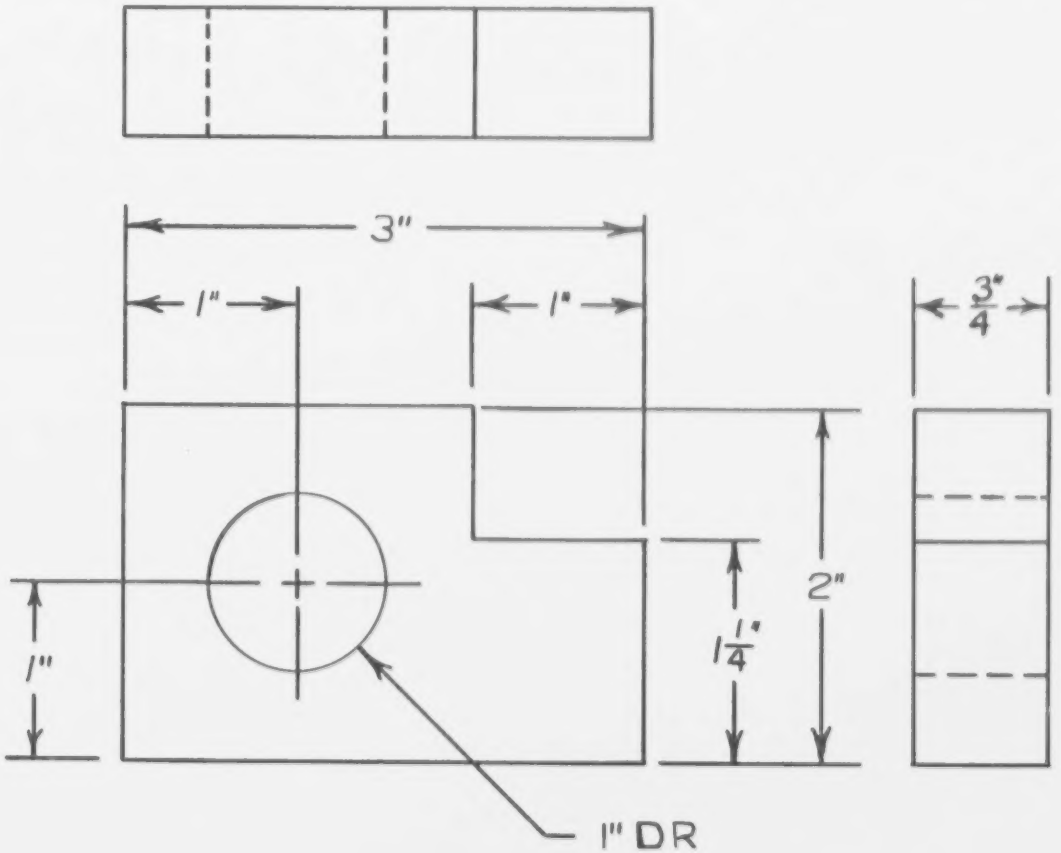












OT #4-1

NAME

60

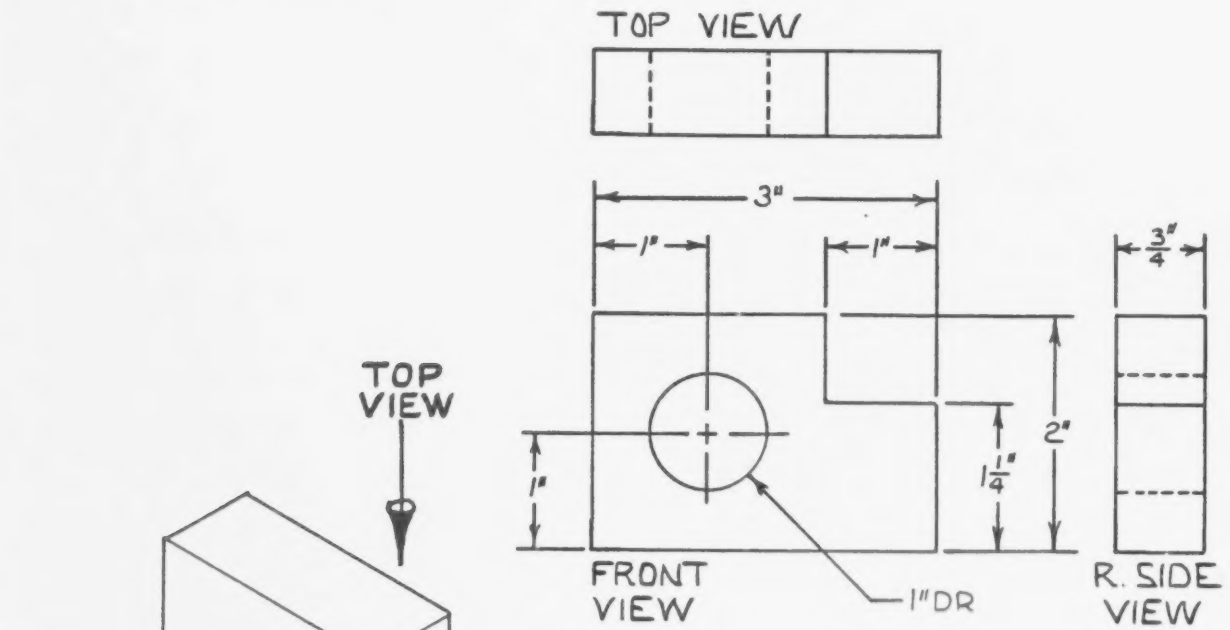
DATE

6

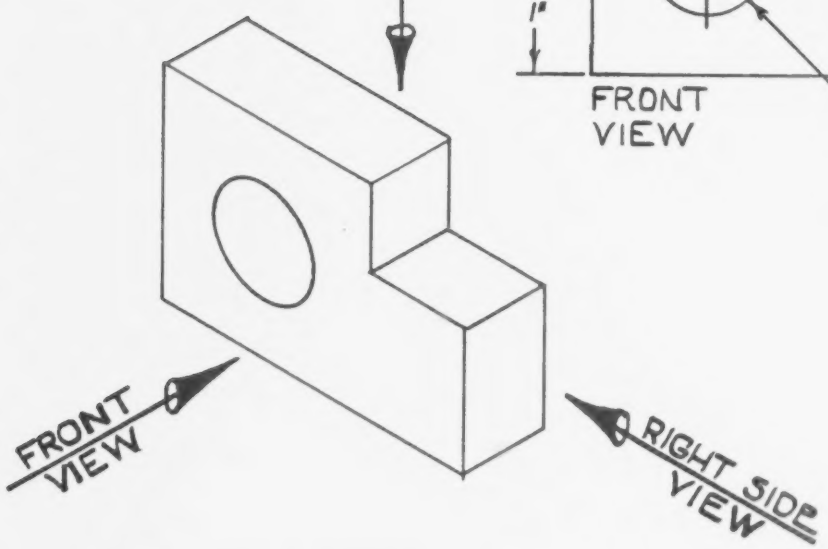
SKETCHING MULTIVIEW DRAWING

Introduction:

Pictorial drawings can show us how something will look before it is made. However, pictorial drawings are often not very helpful when you need to know how to make something. The size, shape, and details of projects can often be communicated better through what are called "multiview drawings." Each view is like looking at the object from a different direction. Because the objects are shown in several views, there are more places to communicate technical information. The three most common views used are a top view, front view and right side view. The illustration below shows the difference between a pictorial drawing and a multiview drawing.



A. Multiview Drawing

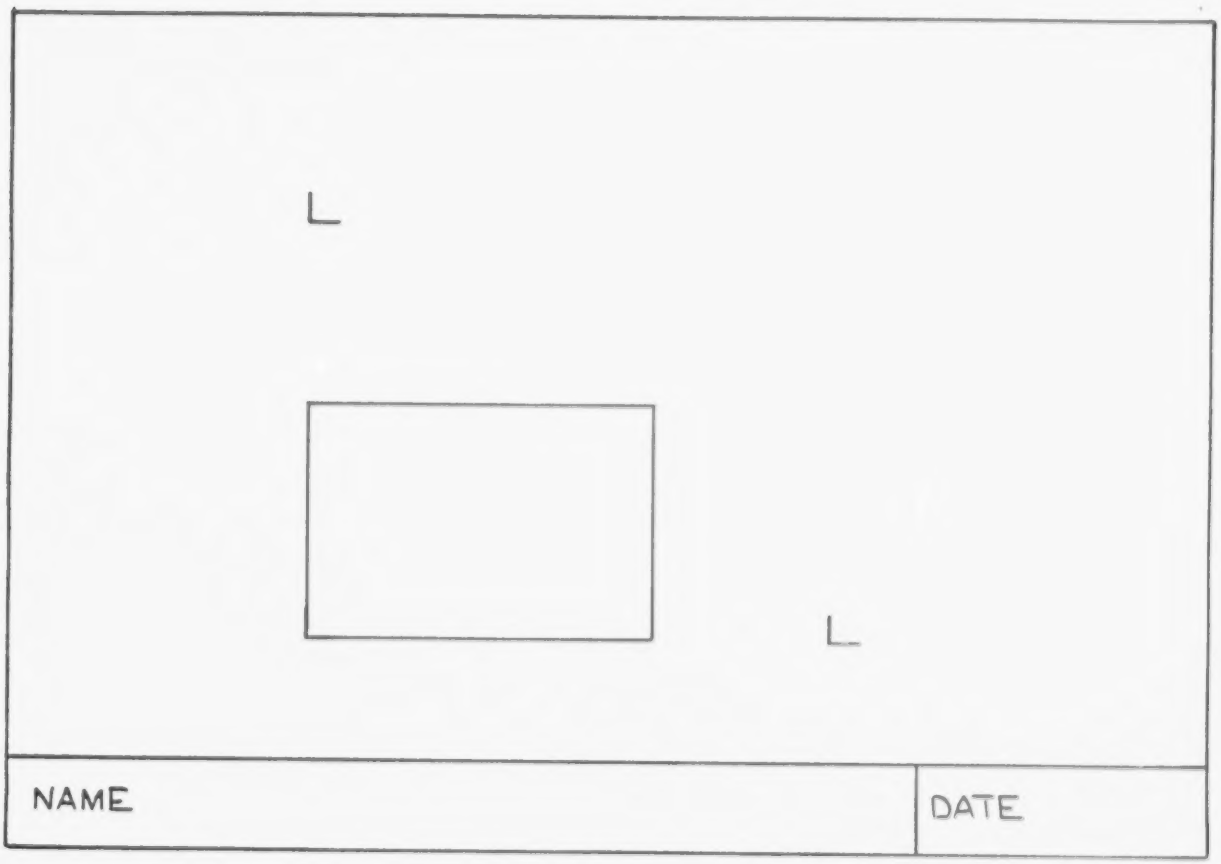


B. Pictorial Drawing

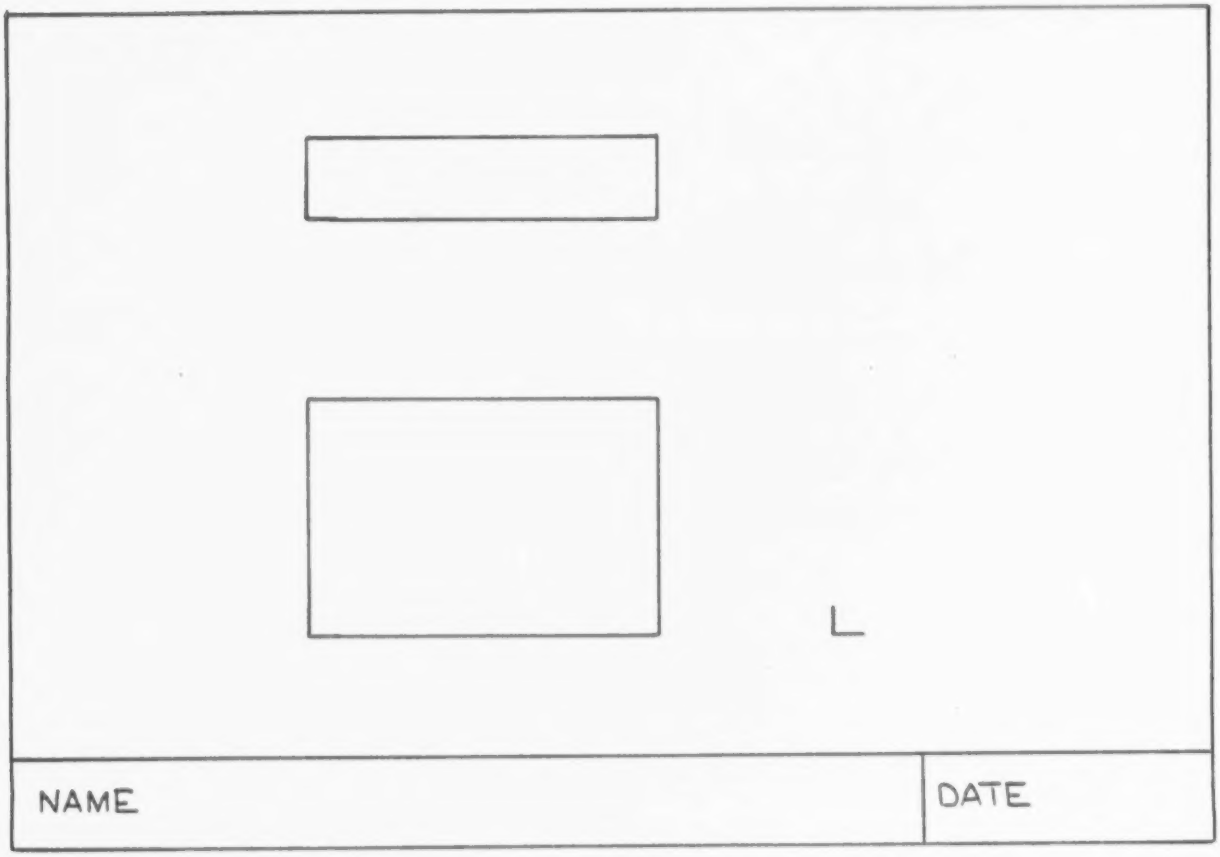
How to Sketch Multiview Drawings:

Before plans are drawn for a new product, designers and engineers usually make several models to see what the product will look like. Using the models as guides, they can draw the plans the production people will use to manufacture the product.

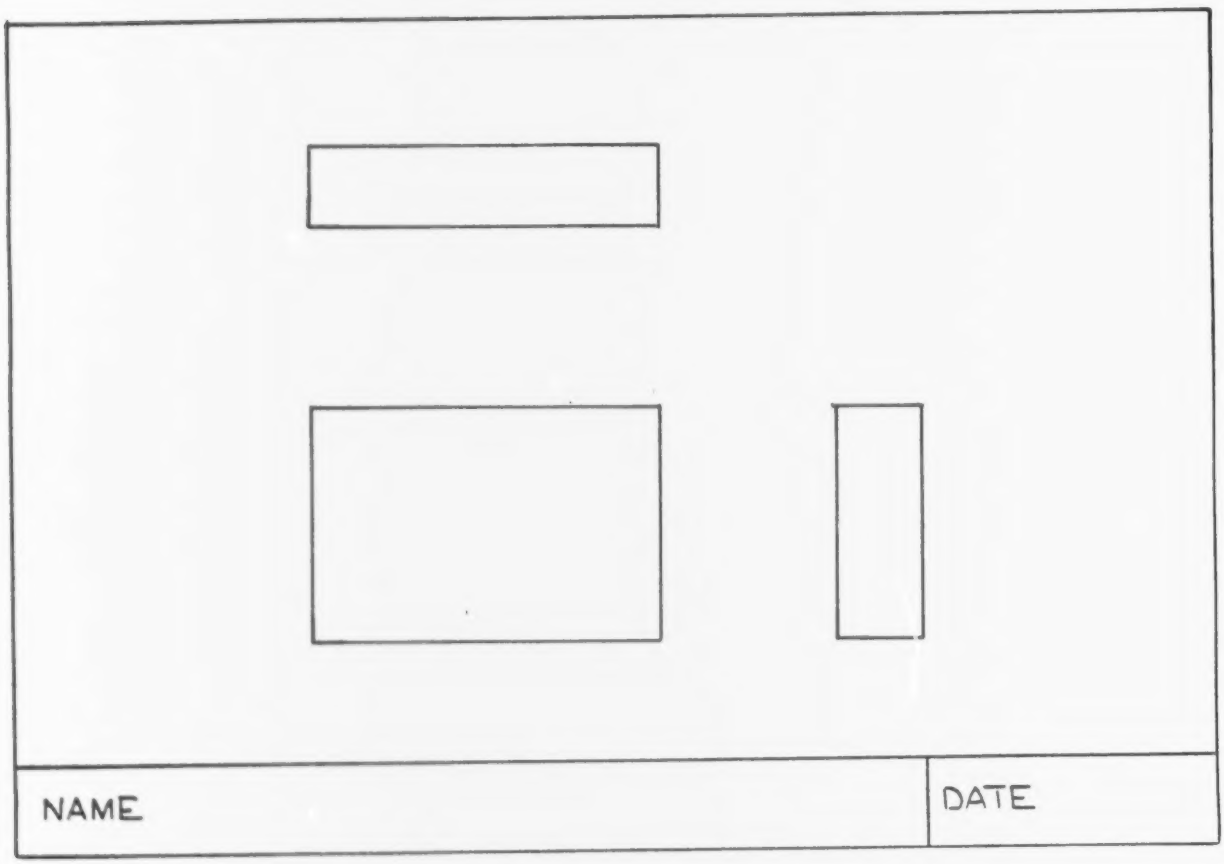
1. The first step in making a multiview drawing is to study and draw the model one view at a time. You will need to know what each view looks like and how big it is. Start by holding your model so all you can see is the front view. Just like your earlier drawings, you want to draw the object's basic shape first. The basic shape for your model is a rectangle. Measure how wide and how high the rectangle is in the front view. Draw a rectangle for the front view in its correct location. Remember, draw lightly first so mistakes are easy to erase.



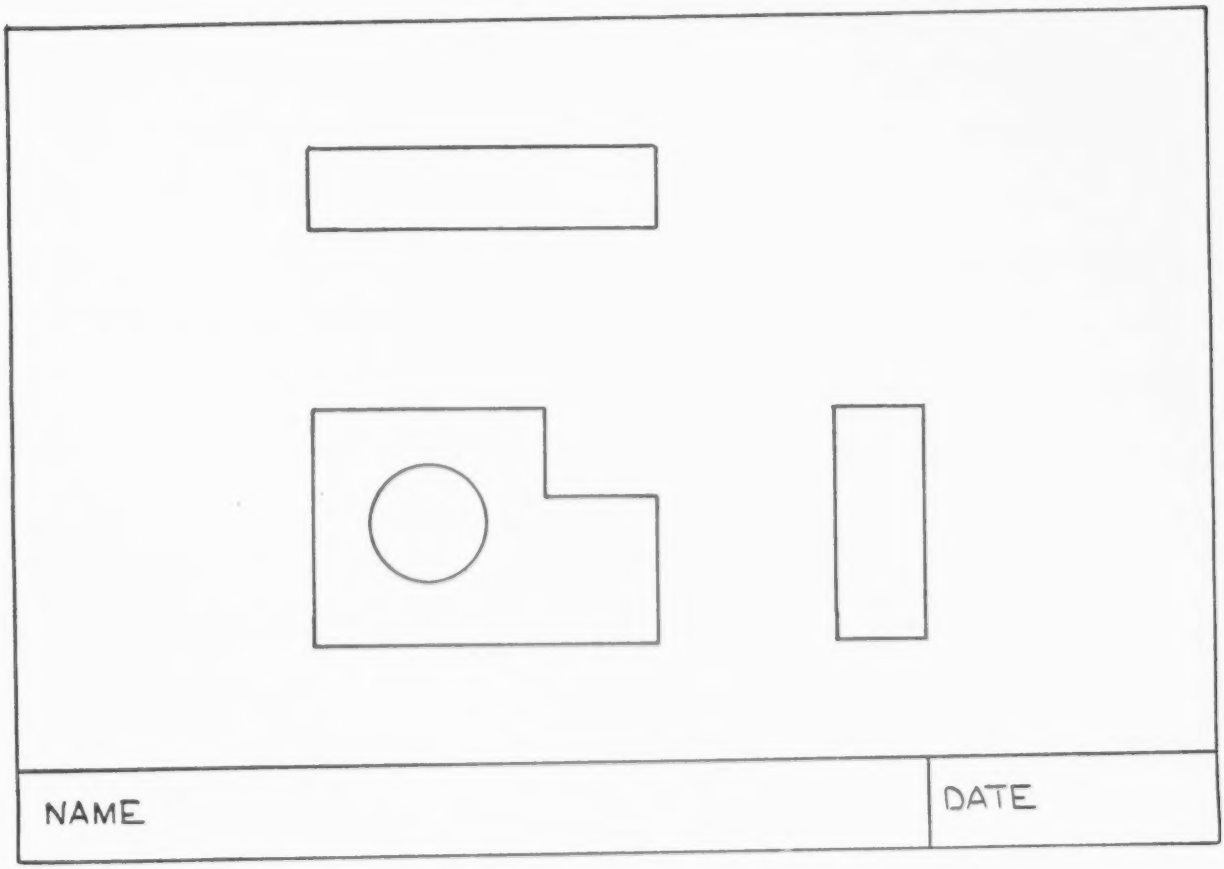
2. Hold your model so all you can see is the top view. The basic shape for the top view is also a rectangle. Measure how wide and how high the rectange is in the top view. Your object should be as wide in the top view as it is in the front view. Draw the top view rectangle in its location. Use the corner mark provided on your drawing. You can project how wide the top view is from the front view.



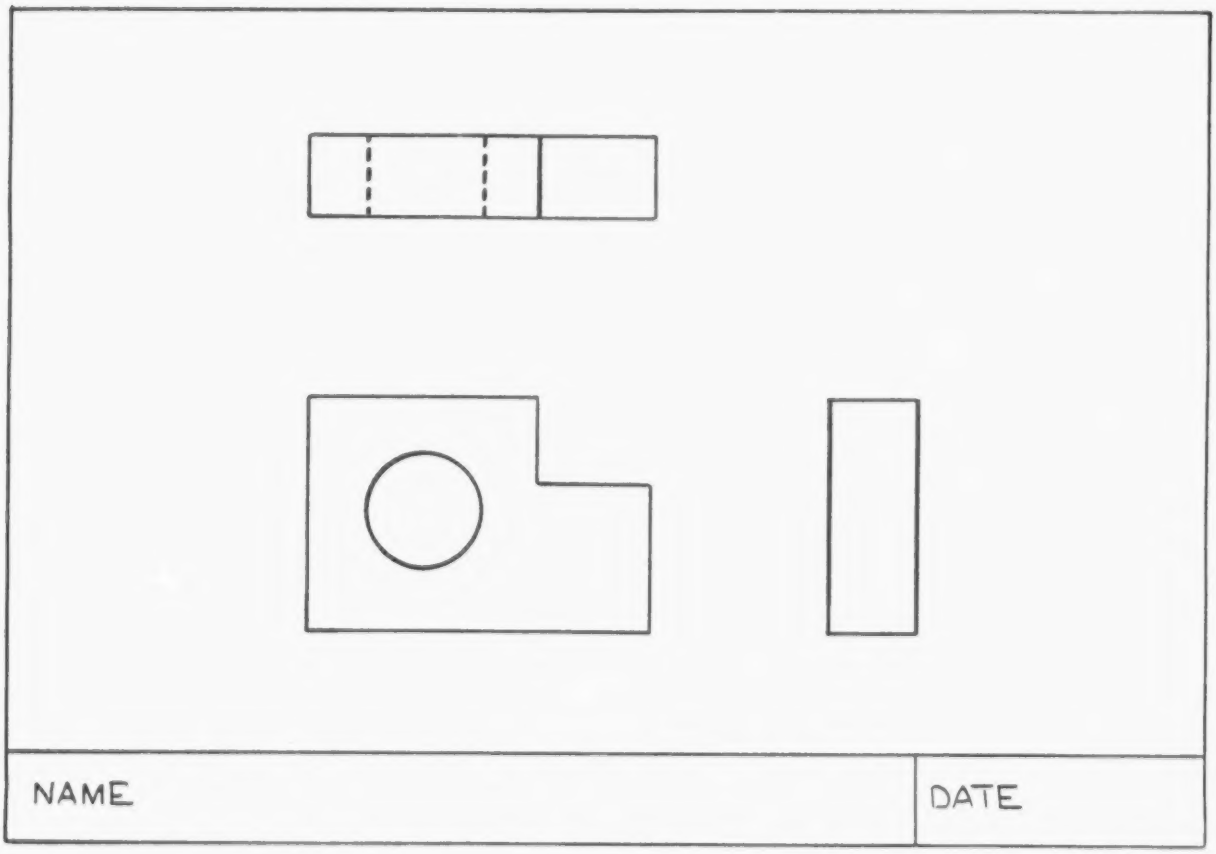
3. Hold your model so all you can see is its right side. Its basic shape is also a rectangle. Measure how high and how deep the rectangle is. The right side should be as high in the right side view as it is in the front view. Draw the right side view in its location and project its height from the front view. You should now have three rectangles on your paper.



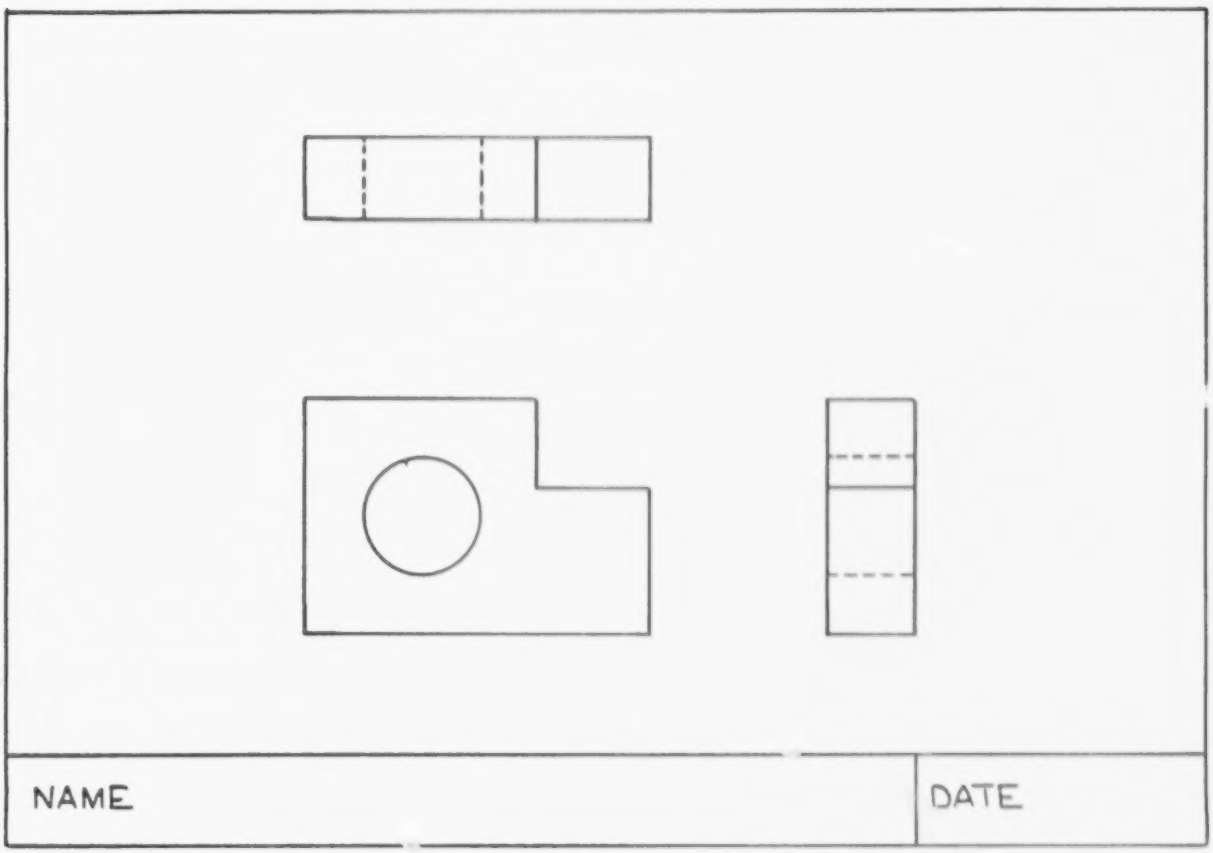
4. The next step in your multiview drawing is to add the features of the object. Study how the features look in the front view first. Measure their size and location and draw them on your front view. Remember to draw each feature with light lines. You may need to erase.



5. Examine the object's features in the top view. You might not be able to see one of the features in the top view even though you know it is there. Even if the feature is hidden from view, you still need to draw it in the top view using hidden lines (lines formed with dashes about 1/8 of an inch long). Use information in the front view to draw the features in the top view.



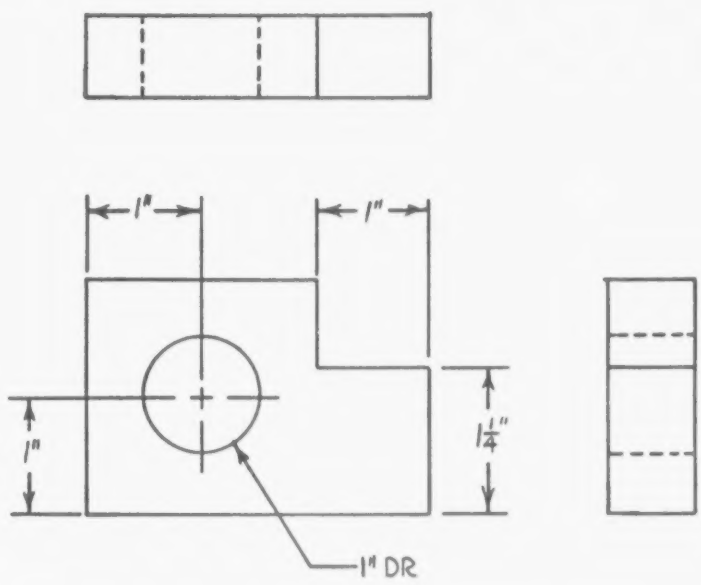
6. Study what the features look like in the right side view. If you cannot see a feature from the right side but you know it is there, draw it using hidden lines. Remember to use information in the front view to draw the features in the right side view.



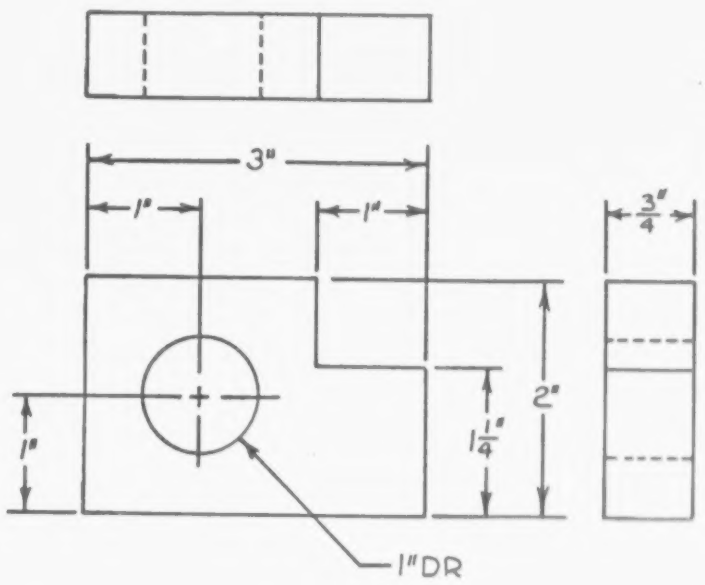
NAME	DATE

7. It is time to check your drawing. Place your model so the front view is facing up next to your front view drawing. Look down at both. They should look the same. Where there are edges on your model, there should be lines on your drawing. Make corrections if you need to. Check the top and the right side views the same way.

8. If your object is drawn correctly, it is time to dimension your drawing. When dimensioning, you start with the features. Dimension the features in the view that shows them best. Once the features have been dimensioned, include the overall dimensions. Refer to the example below.



NAME	DATE



NAME	DATE

9. Your drawing should communicate the size and shape of your model through three views. Erase the unwanted lines and darken in all the object lines.

10. Put your name and the date in the title block. Make sure your drawing is free of mistakes before you turn it in for a grade.

NAME 71

DATE 72

HO #4-1 cont.

UNIT: Using the Language of Industry

LESSON 5: Reading Multiview Drawings

Objectives	Lesson Content	Learning Activities	Ref.
A. Following a discussion and demonstration, in a lab activity, students will read a multiview drawing and be able to: -determine a product's overall dimensions -determine the size and location of given product features. -determine the type of material being specified. -develop a bill of materials for the product.	A. Reading Multiview Drawings 1. reading dimensions a. overall b. details c. determining undefined dimensions 2. reading documentation a. title block b. notes 3. developing a bill of materials a. material b. size c. quantity	A. Learning Activity 1. Discuss the importance of being able to read multiview drawings. 2. Using OT #5-1, discuss and demonstrate how to read a multiview drawing. 3. Explain how to determine the size of the product and its specific features. 4. Explain how to determine dimensions that are not documented on the drawing. 5. Demonstrate how to develop a bill of materials from a multiview drawing. 6. Provide each student with HO #5-1 and make sure each student has paper and a pencil. 7. Have students read the multiview drawing and answer the questions provided. 8. Provide individual instruction and feedback as needed. 9. Collect and evaluate the lab activity.	TA #5-1: Reading Multivew Drawings OT #5-1: Multiview Drawings HO #5-1: Reading Multiview Drawings

READING MULTIVIEW DRAWINGS

Introduction:

Encoding and transmitting technical information through drafting is only the beginning of the communication process. Students need to role play the receiving and decoding process to have a complete exploration experience in drafting communication. After most of your students have successfully drawn a multiview drawing, introduce them to the concept of reading a multiview drawing. Discuss the relationship between drafters (senders) and the variety of people that will need to read drawings (receivers) in an industrial context. You may want to limit your discussion to manufacturing because construction will be discussed during the architechtural drawing activities. Provide examples that include personnel from a research and development, marketing, quality control, purchasing, production, consumer, and servicing context. It should be made clear to students that more people read drawings than make drawings in industry.

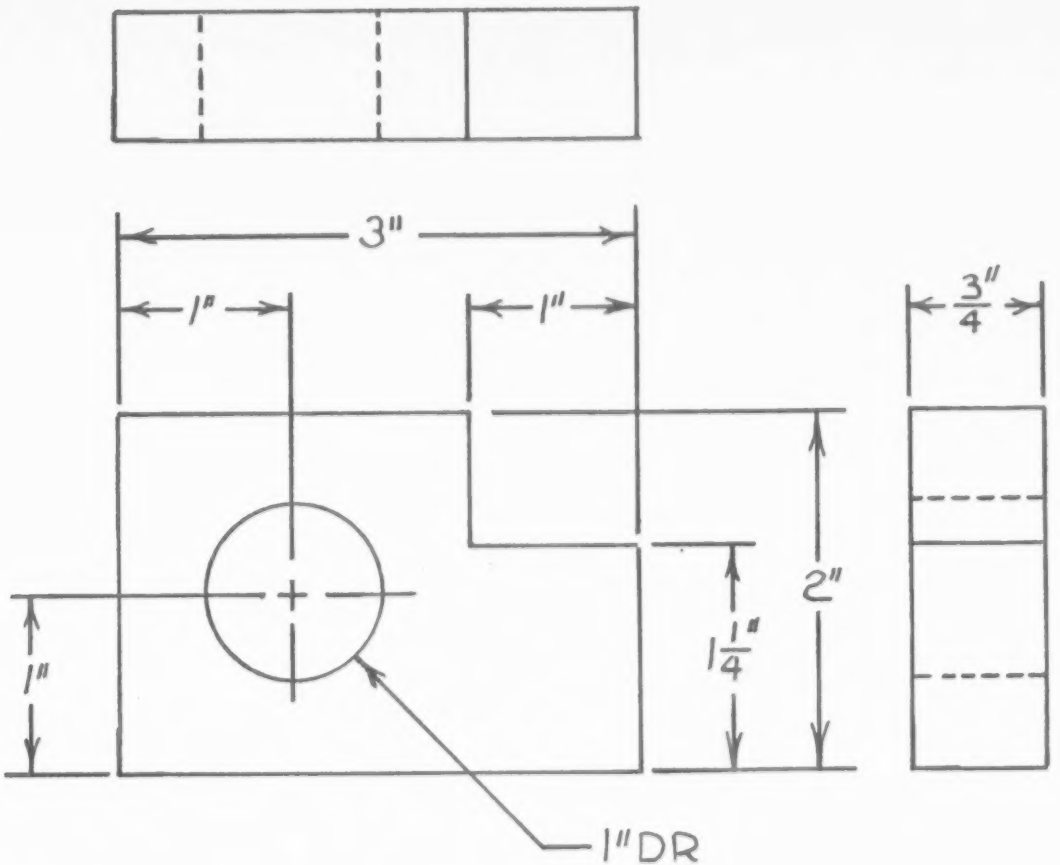
How to Read a Multiview Drawing:

Using OT #5-1, discuss how the dimensions can be used to determine the size of the product, the size of its parts, and the location of specific features on the product. Explain and demonstrate how the dimensions provided can be used to determine dimensions that often have been omitted. Discuss the communication role of notes and title block on the drawings. Explain and demonstrate how to develop a bill of materials from a drawing. Have students participate in the demonstration by answering questions. Make sure you discuss how a product may require more than one part that is the same size. For example, your students need to understand that the right side and the left side of a box are the same size and are not documented separately. The quantity column is used to document parts that are repeated in a product.

Learning Activity:

Provide each student with HO #5-1. Have them read the plan and complete the lab sheet provided. Circulate around the class room and provide individual instruction as needed. Before the end of class, tell students how they are doing and make whatever general recommendations are necessary. Try to keep your feedback as positive as possible. Gathering information from a visual medium of this kind will be new to many of your students. Collect the lab sheets at the end of the class period. Evaluate the lab sheets in

terms of the accuracy of the information gathered. When you return the lab sheets, you may want to allow students to correct them on their own time and turn them in for a second evaluation.



OT #5-1

NAME

DATE

READING MULTIVIEW DRAWINGS

Introduction:

In industry, more people have to be able to read a drawing than are able to make a drawing. After a drafter (sender) has developed a set of drawings for a new product, a variety of people (receivers) will need to read the drawings in order to make the product. Engineers will check the drawings for design errors. Purchasing people will read the drawings to determine the materials or parts that have to be ordered. Production people will read the drawings to organize the people and machines needed to manufacture the product. The quality control staff will have to check the parts produced to make sure they match the drawings. Technical writers will read the drawing to write service and owners manuals for the new product. Lastly, the consumer may have to read drawings in order to assemble or install the new product. Multiview drawings have real value when one knows how to read them.

Reading Multiview Drawings:

1. You work in the packaging department and you have been asked to make shipping containers for the company's new speaker. The shipping containers need to be two inches larger than the speaker (width, length and depth) to allow for styrofoam packing materials, which will protect the speakers during shipping. Read Drawing A provided on the following page to determine the dimensions of the shipping container.

   Length = _____ inches

   Width = _____ inches

   Depth = _____ inches

2. You have been transferred to the engineering department. The head engineer decides that the tweeter (small speaker) is too close to the woofer (big speaker) on the new model. If the woofer and tweeter are closer than eight inches, the speaker cabinet will have to be redesigned. Check Drawing B on the following page and determine the distance between the tweeter and the woofer.

   The distance between the woofer and tweeter is _____ inches.

3. You have been transferred again. This time you are in the purchasing department. The manager wants to call her suppliers and order the materials for the new speaker cabinet. She wants to know what size woofers and tweeters to order for the new model. In addition, she wants to know what kind of material and fasteners will be used to make the new speaker cabinet. Read the drawing and determine the information needed.

Tweeter size = _____ inches

Woofer size = _____ inches

Cabinet material is ____ inch _____.

The fastening materials needed are _____ and _____.

4. Guess what? You now work for the production department. The shop foreman wants you to set up the router to machine the joints for the top, bottom and sides. In order to choose the right cutting tool, you need to know what kind of joint is being used. Read the drawing and determine which of the following joints is being used.

_____ butt joints

_____ dado joints

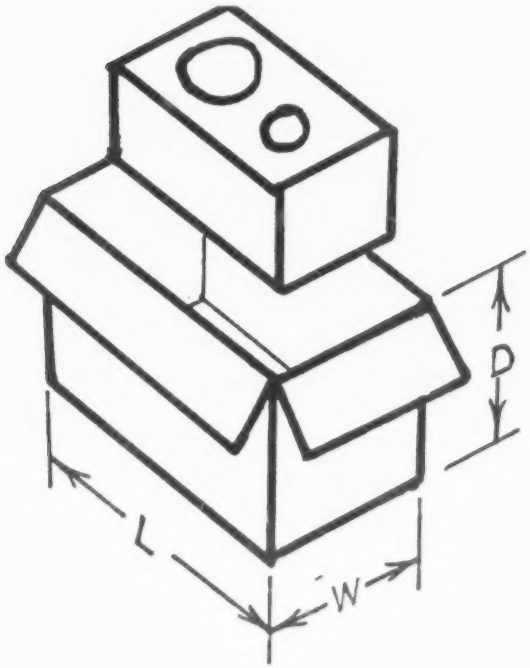
_____ miter joints

_____ rabbet joints

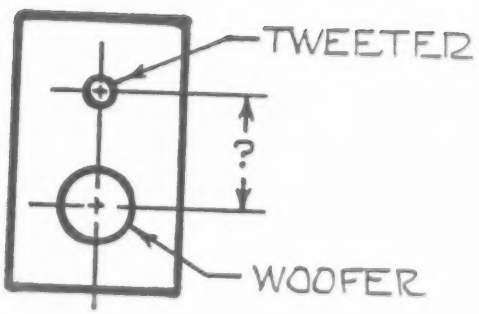
5. The material needed to make the speaker cabinets comes in large sheets. The cabinet parts will need to be cut out of the sheets with as little waste as possible. The machine operators need to know the sizes and number of parts required to make each cabinet. A list of parts and their sizes is called a bill of materials. Read the drawing and develop a bill of materials for one speaker cabinet.

BILL OF MATERIALS

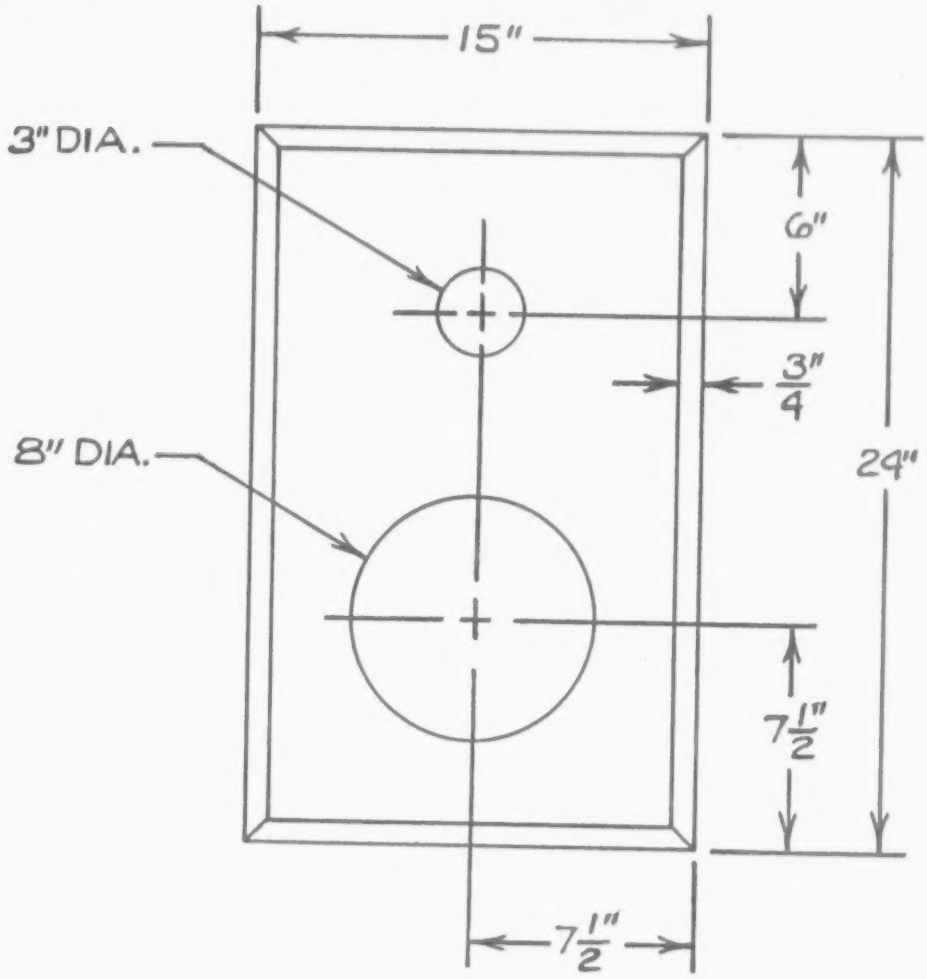
PART NAME	SIZE THICKNESS x WIDTH x LENGTH	QUANTITY

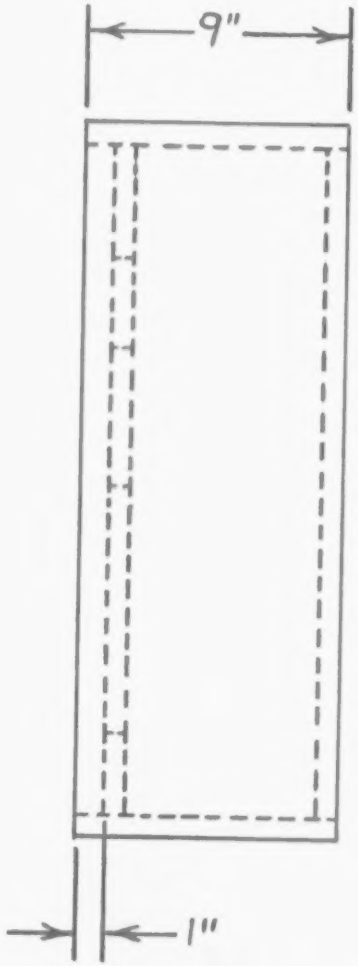


Drawing A



Drawing B





NOTES:
1. MITER TOP, BOTTOM, AND SIDES
2. FASTEN ALL JOINTS WITH WHITE GLUE AND 4D FINISHING NAILS

MATERIAL:
3/4" PARTICLE BOARD

SCALE:
1/2" = 3"

NAME: JIM SMITH	TWO-WAY SPEAKER ENCLOSURE	DATE: 4-20-86

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HO #5-1 cont.

83

UNIT: Using the Language of Industry

LESSON 6: Developing an Architectural Floorplan

Objectives	Lesson Content	Learning Activities	Ref.
A. Following a discussion, students will be able to identify: -the purpose of architectural drawings. -basic architectural symbols (windows, doors, cabinets, fixtures, etc.). -applications for floorplans -the three basic areas on a floorplan.	A. Architectural Drawing 1. Architectural drawing is a tool used to communicate technical information about building. 2. Floorplans a. illustrate a cut-away view of a building from above. b. help people plan or evaluate buildings for specific applications c. are used to design, build, sell and service buildings 3. Basic areas on a house floorplan a. sleeping area (bedrooms and bathrooms) b. work area (kitchen, laundry, and garage) c. living area (living, dining, and family rooms) 4. Basic Architectural symbols a. walls b. windows and doors c. cabinets d. kitchen appliances e. bathroom fixtures f. decks and landscaping	A. Teacher Guided Discussion 1. Discuss how all buildings start out as someone's ideas that were developed into architectural drawings. 2. Explain what a floorplan illustrates and discuss its communication value and its applications. 3. Using OT #6-1, discuss the three main ideas in a house and the architectural symbols used on floorplans. 4. Use OT #6-1 through 12 to demonstrate how templates can be used to to develop floorplan.	TA #6-1: Developing an Architectural Floorplan OT #6-1 through 11: Developing an Architectural Floorplan

B. Following a demonstration, in a lab activity, using templates, students will be able to develop a floorplan for a vacation cottage that includes: -the three basic areas of a house (sleeping, living and working). -doors and windows symbols. -decks and landscaping symbols. -basic dimensions and documentation.	B. Developing a floorplan 1. layout the sleeping area a. bedroom b. bathroom c. closets d. doors 2. layout the working area (kitchen) 3. layout the living area (great room) 4. locate windows and doors 5. locate decks and landscaping 6. darken in the walls 7. dimensioning and documenting	B. Learning Activity 1. Provide each student with HO #6-1 and a piece of graph paper, scissors, gule and pencil. 2. Review the instructions for the activity and answer all questions. 3. Have students start laying out their floorplans. 4. Before the end of the period, provide students with feedback regarding their floorplan development. 5. Collect, evaluate, and/or display the floorplans.	HO #6-1: Developing an Architectural Floorplan

DEVELOPING AN ARCHITECTURAL FLOORPLAN

Introduction:

Since the time is limited, exploring architectural drawing will focus on floorplans. Explain to students that drawings that communicate technical information about building are called architectural drawings. Explain that the most commonly used architectural drawing is a floorplan. Using OT #6-1, show students what a floorplan looks like. If your school has developed 8 1/2" x 11" floorplans of the school for public events, make copies or a transparency and share it with your students. They understand the layout of the school and will be able to make relationships between the floorplan and the school better than an abstract floorplan. Explain how floorplans are basically a bird's eye view of a building with the roof removed. An architectural model will reinforce this concept if you have access to one.

List on the chalk board various types of buildings that require a floorplan to be made prior to their construction. Include unique examples of floorplan applications like recreation vehicles and shopping mall directories. Explain how floorplans are used to design, construct, sell and service buildings. Provide examples for each application. More attention will be given to this during the floorplan reading activity.

Discuss the three basic areas common to all house floorplans. Using OT #6-1, point out the sleeping, working, and living areas. If you want to, obtain 8 1/2" x 11" floorplans for houses being built in your community. For a homework assignment, students could color code the rooms in terms of their area.

Illustrate and discuss the basic architectural symbols used to represent things like walls, doors, windows, cabinets (base cabinets and upper cabinets), kitchen appliances, bathroom fixtures (vanities, lavatories, water closets, bathtubs, and showers), decks and landscaping. Limit the symbols discussed to those students will need to use in their activity. It would be easy to give students more information than they can remember or use.

How to Develop a Floorplan:

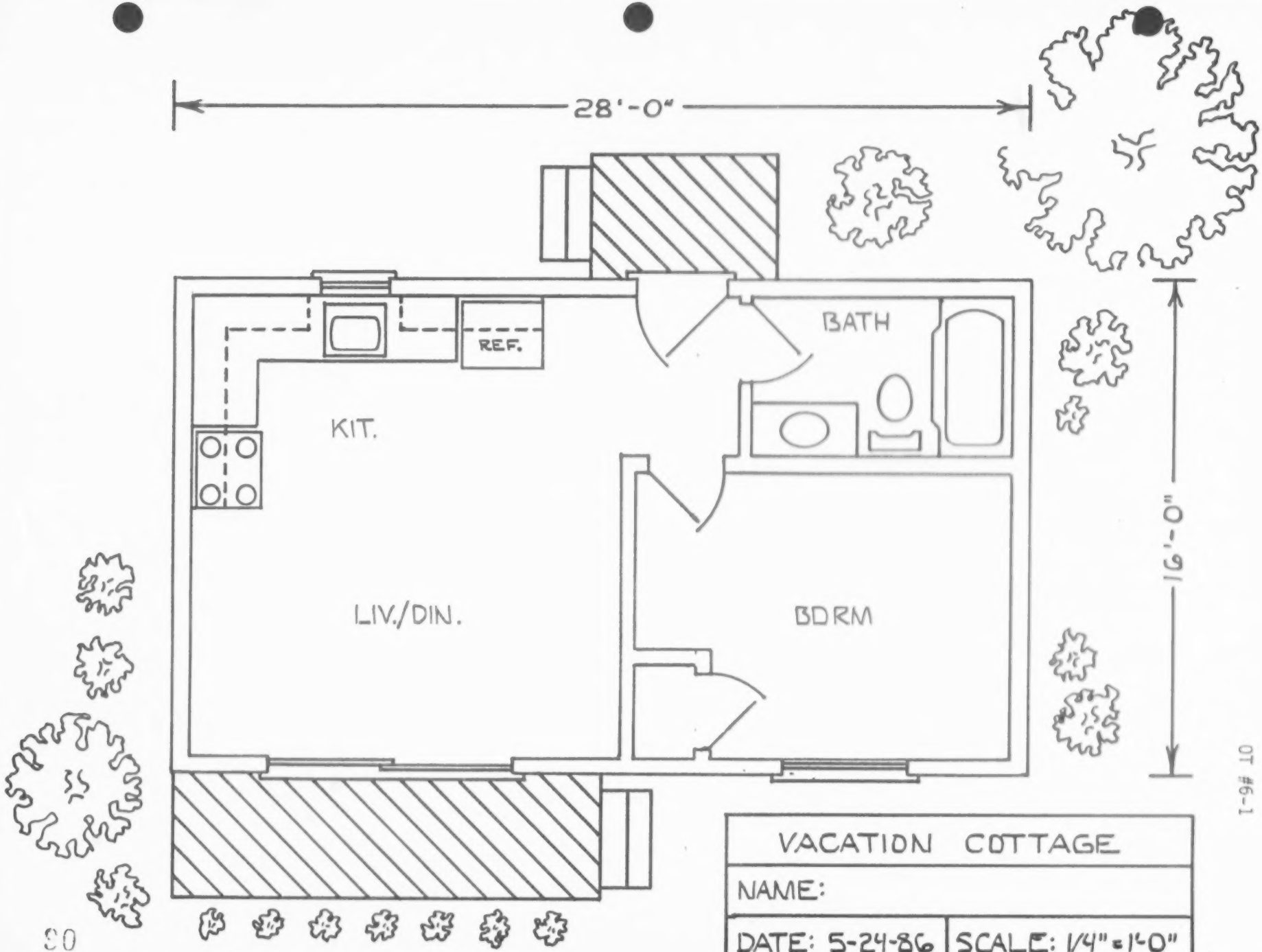
The learning activity provided uses the template technique to develop a floorplan. The technique should save a lot of time. Using templates still requires the students to perform encoding and visual thinking. Use OT #6-2 through OT #6-7 to illustrate how to develop a floorplan using the templates and symbols provided. Start with the sleeping

area and progress to the working and living area. Make sure students understand that walls can be overlapped to create a common wall between two rooms. Demonstrate how to locate windows and doors. Discuss privacy, egress and view considerations when locating doors and windows. Tell students that they should imagine living in the cottage that they are developing.

Demonstrate how to locate decks and landscaping symbols. Lastly, discuss how to include basic documentations (label the rooms) and dimensions (longest length and greatest width). When the students have completed their floorplans, they should have the same basic communication value as those found in magazines.

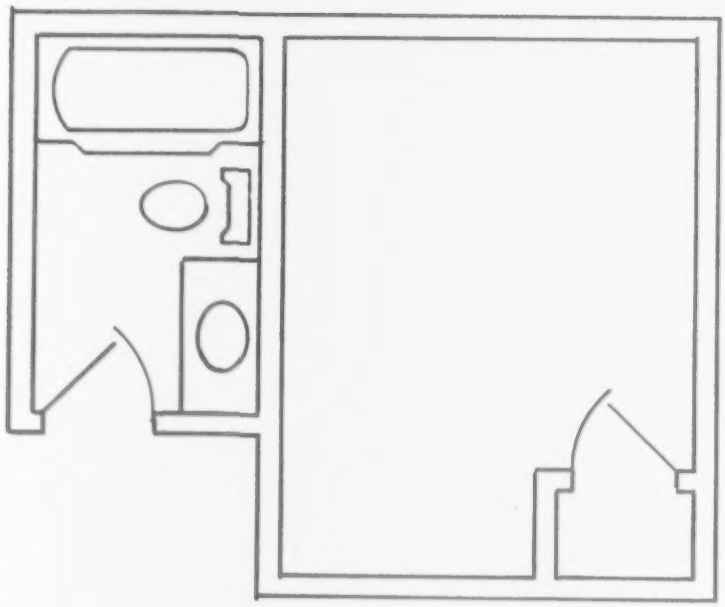
Learning Activity:

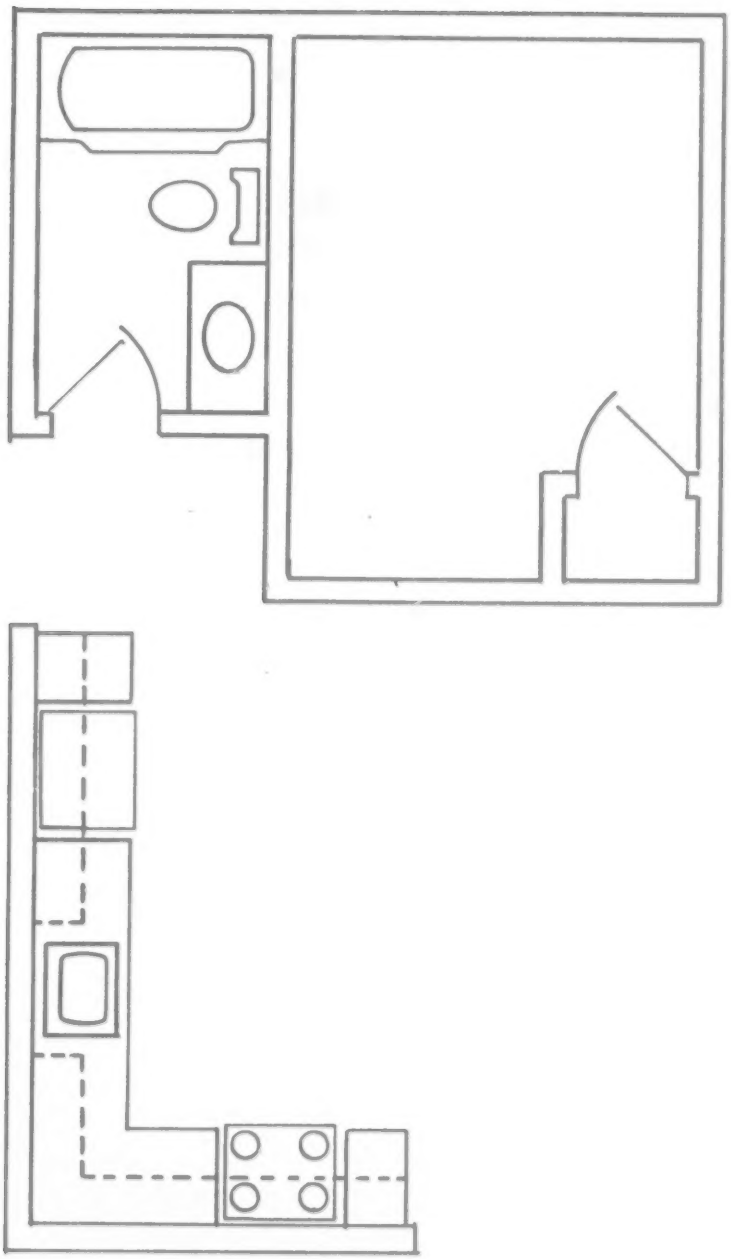
Provide each student with HO #6-1 and a piece of graph paper, scissors, glue, and pencil if appropriate. Since the scale being used for the floorplans is 1/4" = 1'-0", the graph paper should have eight squares to the inch. However, four squares to the inch will work. In order to help your students be more successful with the activity, you may want to let them use a straight edge to layout and draw their lines. Review the instructions for the activity and allow students to ask questions before they begin the activity. Have your students begin developing their flooplans. Circulate around the classroom and provide individual instruction as needed. Some of your students will forget to overlap walls when they layout the room templates. In addition, they will have some difficulty with traffic patterns. Ask students questions about their floorplans and provide clues when modifications are needed. Before the end of class tell students how they are doing and make whatever general recommendations are necessary. Try to keep your feedback as positive as possible. Collect the drawings at the end of the class period. Evaluate the drawings in terms of their communication value. Try not to put too much emphasis on details that do not compromise basic communication. When the drawings are returned, allow students to correct their drawings on their own time and turn them in for a second evaluation. You may want to display all or some of the multiview drawings.

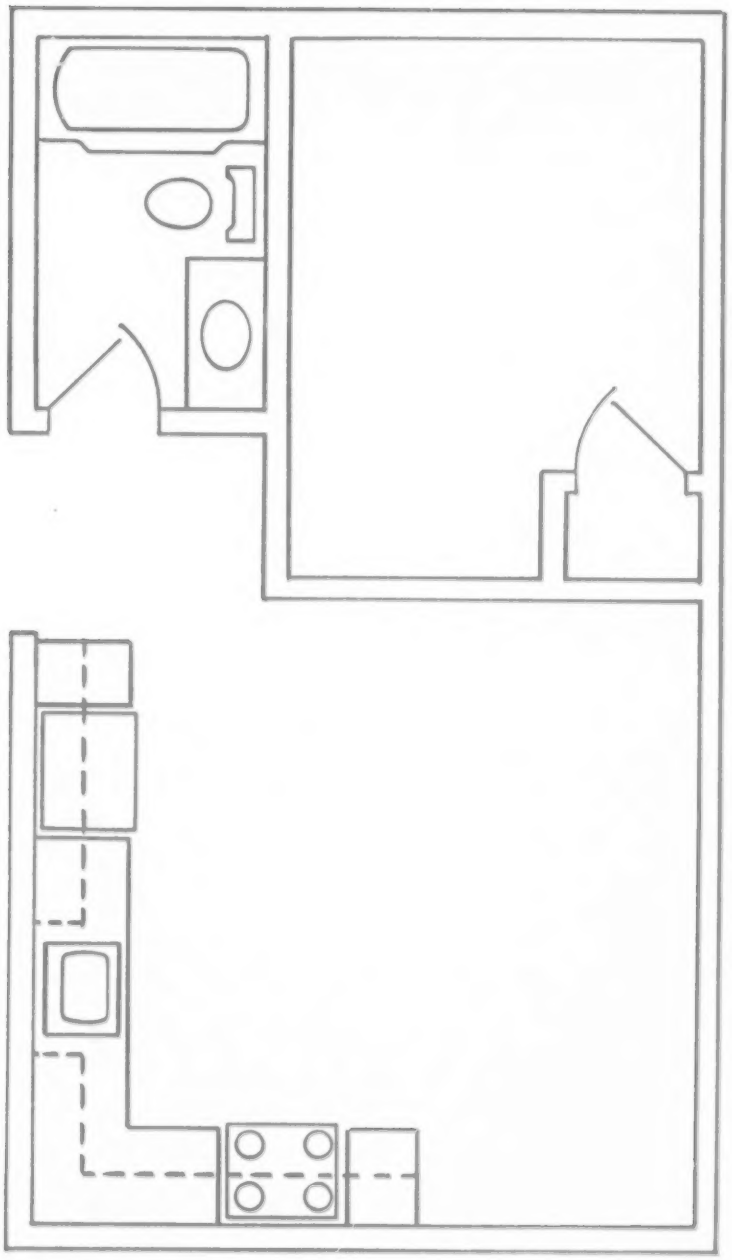


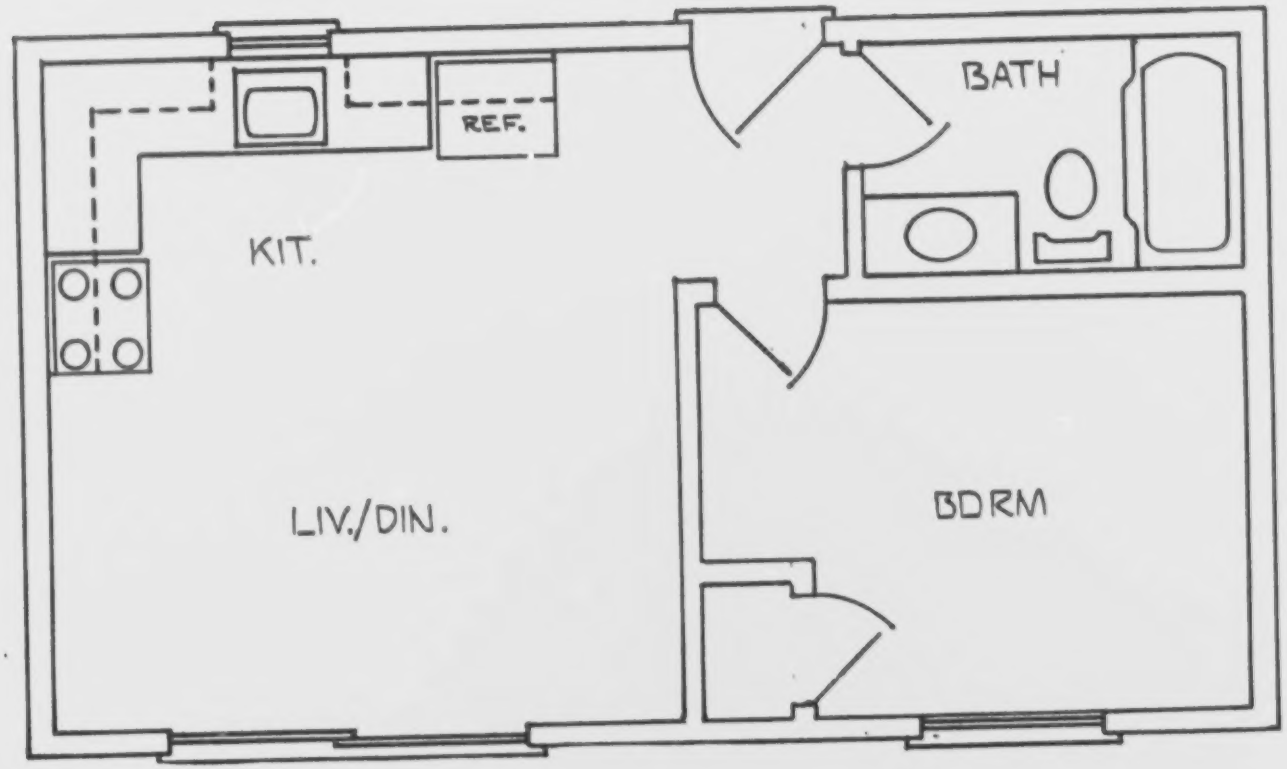
VACATION COTTAGE	
NAME:	
DATE: 5-24-86	SCALE: 1/4" = 1'-0"

OT #6-1

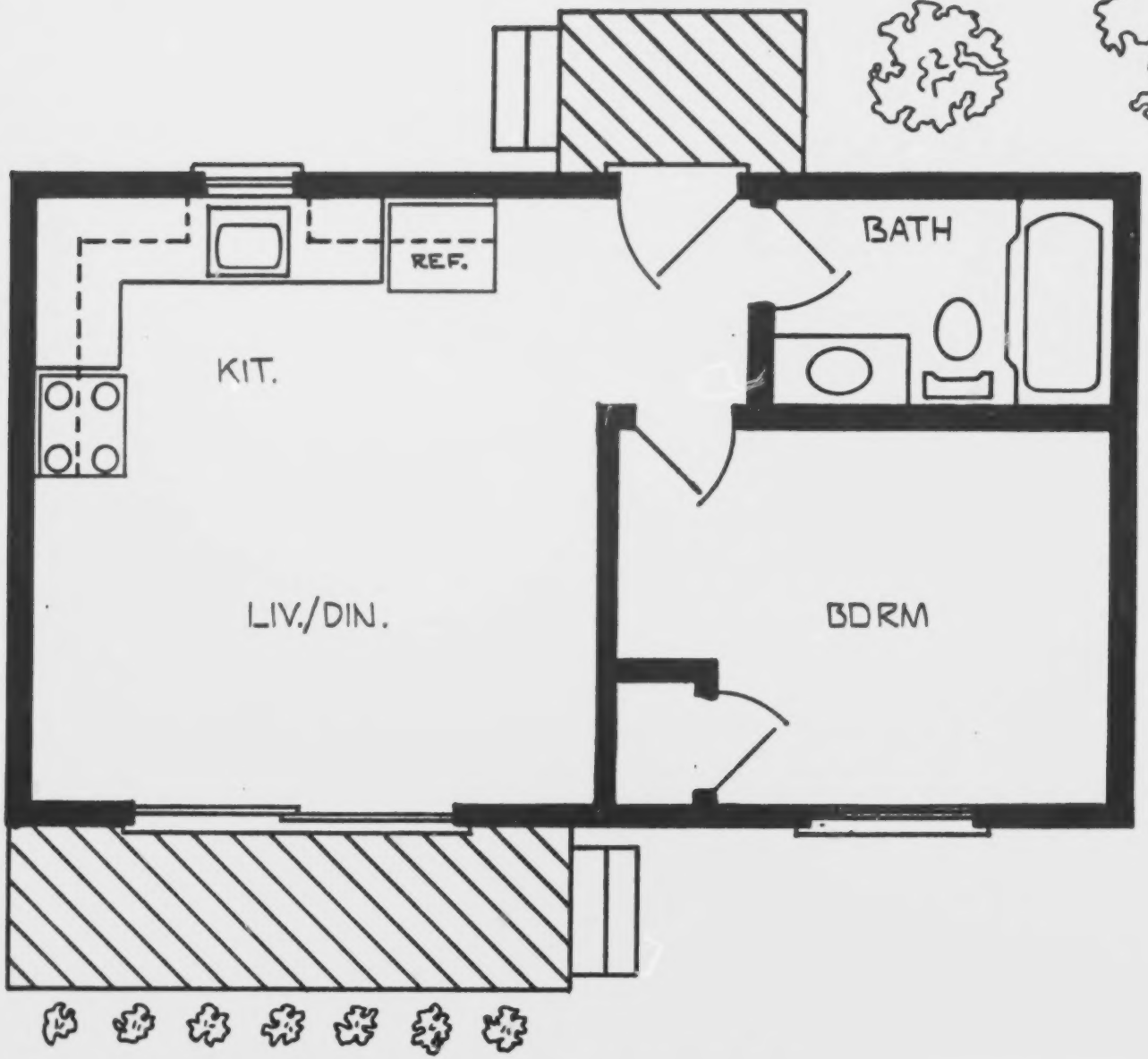




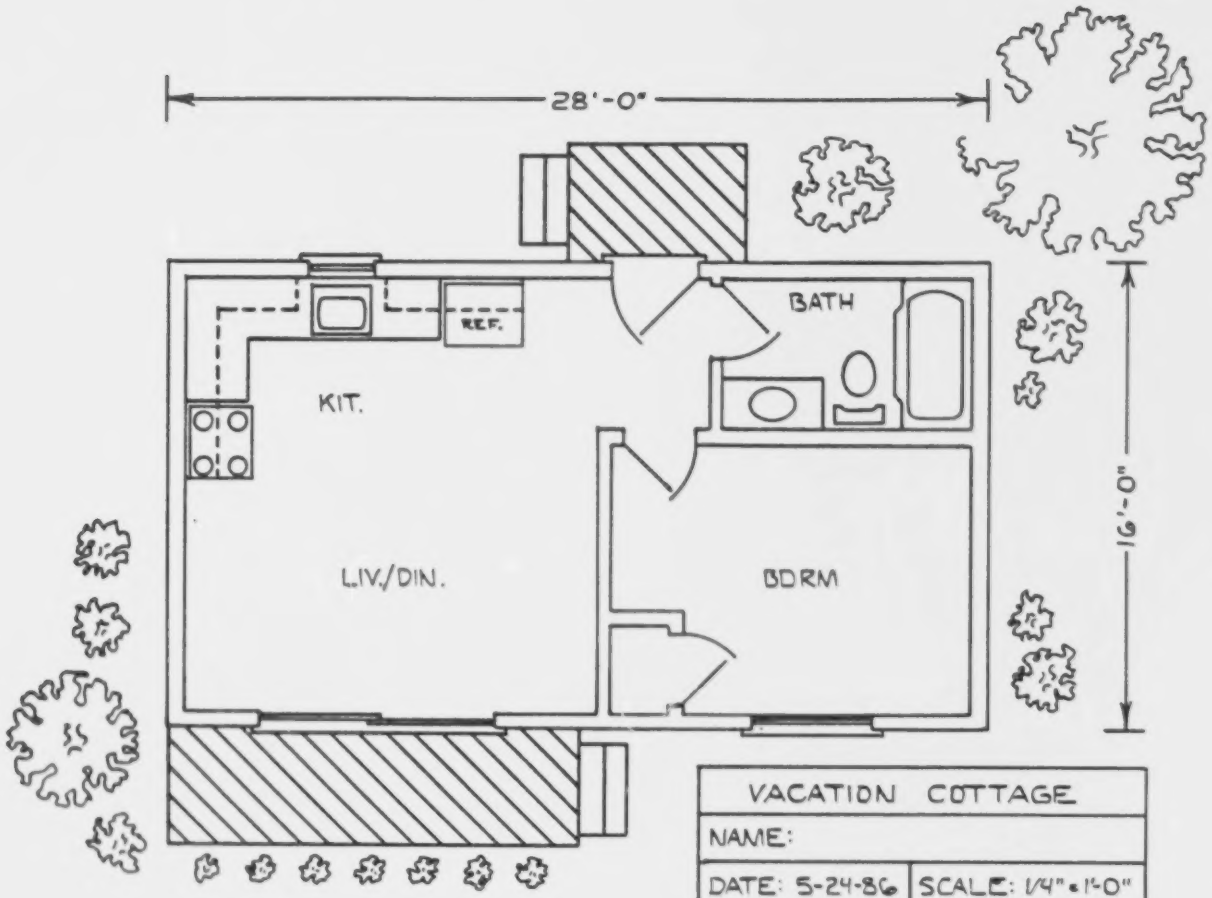




OT #6-5



OT #6-6



VACATION COTTAGE	
NAME:	
DATE: 5-24-86	SCALE: 1/4" = 1'-0"

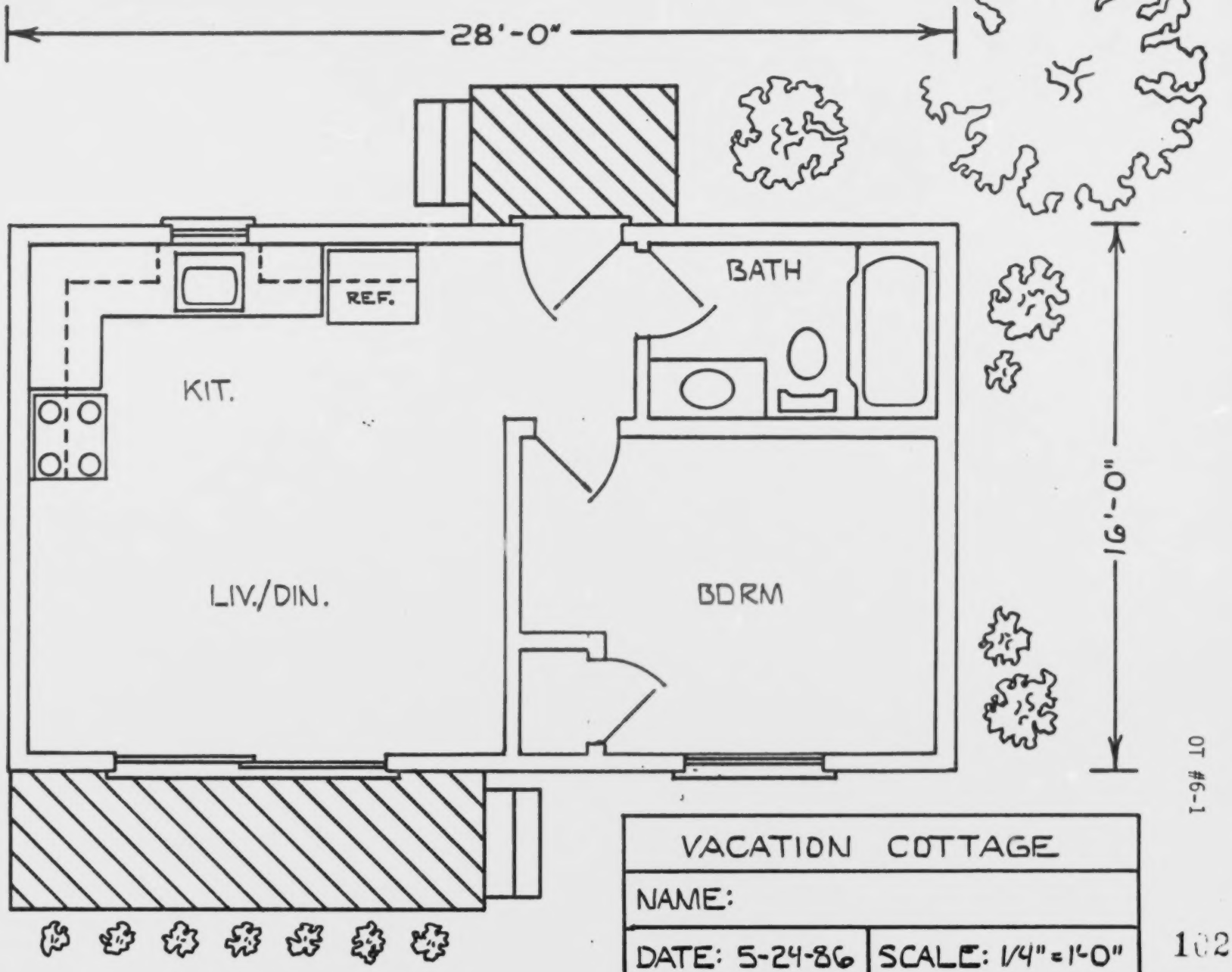
DEVELOPING AN ARCHITECTURAL FLOORPLAN

Introduction:

Houses, apartments, office buildings, factories, shopping malls, schools, and even recreational vehicles started out as ideas in someone's mind. When ideas about buildings are drawn on paper they are called architectural drawings. Architectural drawings are very important communication tools when designing, building, selling, and servicing buildings.

The most commonly used type of architectural drawing is called a floorplan. Floorplans are a form of cut-away drawing. They show what a building would look like if you cut the top off and looked down from above. Floorplans can provide more information about a building than any other type of architectural drawing. They show locations for rooms, windows, doors, cabinets, bathroom fixtures, storage, fireplaces, and much more.

Floorplans would be impossible to draw without symbols. Simple easy-to-draw and understand symbols are used to represent things like doors, windows, bathroom fixtures, appliances and more. Look at the floorplan on the following page and see if you can recognize all the symbols used.



VACATION COTTAGE	
NAME:	
DATE: 5-24-86	SCALE: 1/4" = 1'-0"

OT #6-1

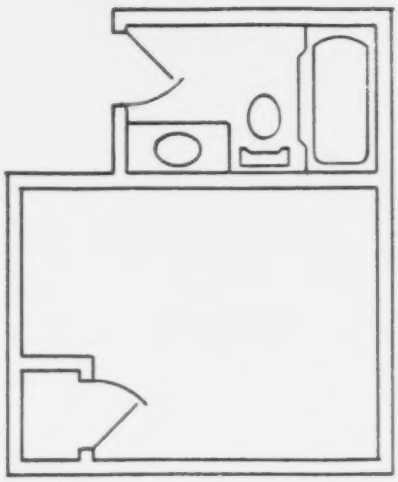
In order for a building to be functional, it must meet the needs of the user. To meet the needs of the user, houses have three basic areas. These areas are the sleeping area, working area, and living area. The sleeping area includes bedrooms, bathrooms, and closets. The work area includes the kitchen, laundry room, and the garage. The living area is made up of the living room, family room and the dining room. These areas are organized on the floorplan so people can move freely inside the house, enjoy outside views, and have privacy.

Architects often use templates to develop a floorplan. Each template represents a room. The rooms are arranged into areas by moving the templates around until a good combination is developed. Once the areas have been layed out, they are arranged into a building. Using movable templates allows the architect to explore a lot of floorplan options very quickly. After a good floorplan has been developed, a very detailed set of plans can be drawn.

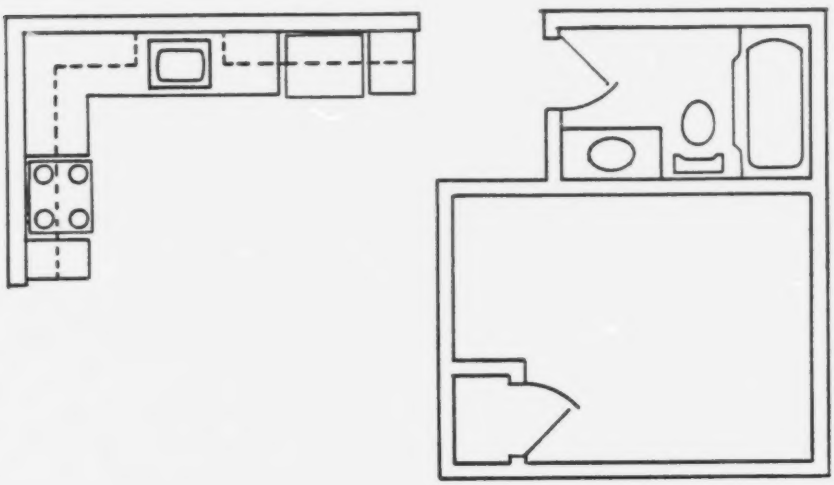
How to Develop an Architectural Floorplan:

You are working for an architectural firm as a drafts-person. One of the firm's customers wants to build a vacation cottage but he/she is not sure what it is to look like. .The cottage is to have a kitchen, one bath, and one bedroom with at least one closet. The cottage only needs to accomodate two people so it does not need to be very big. Your job is to develop a possible floorplan for the customer to look at and evaluate. Develop the floorplan using a piece of graph paper and the templates provided.

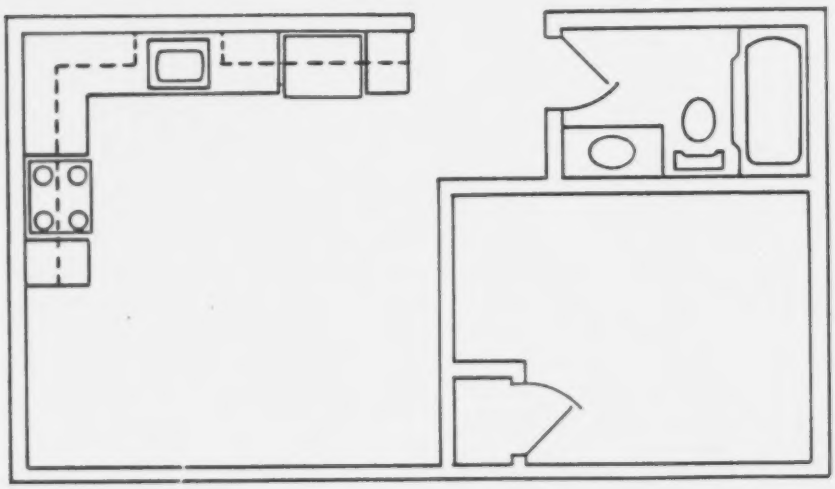
1. The first step in developing your floorplan will be to lay out the sleeping area (bedroom, bathroom and closet). Choose and cut out the templates you want to use and locate them on your graph paper. You may want to move them around until you have found the arrangement you like best. Do not glue them down; you may want to change them later. Do not worry about adding windows and doors yet. See the illustration below for an example.

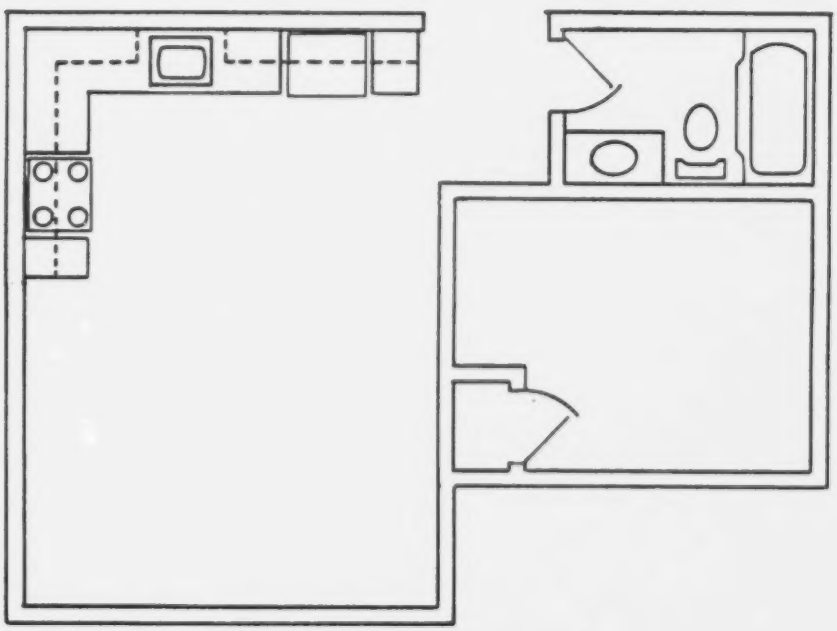


2. For the next step you need to locate the working area. Choose and cut out the kitchen style you like best. Locate it on the graph paper. Try several locations. Make sure the kitchen does not interfere with the bathroom or the bedroom. The kitchen does not need to touch the other rooms. Do not glue yet. For an example of a kitchen location, see the illustration below.



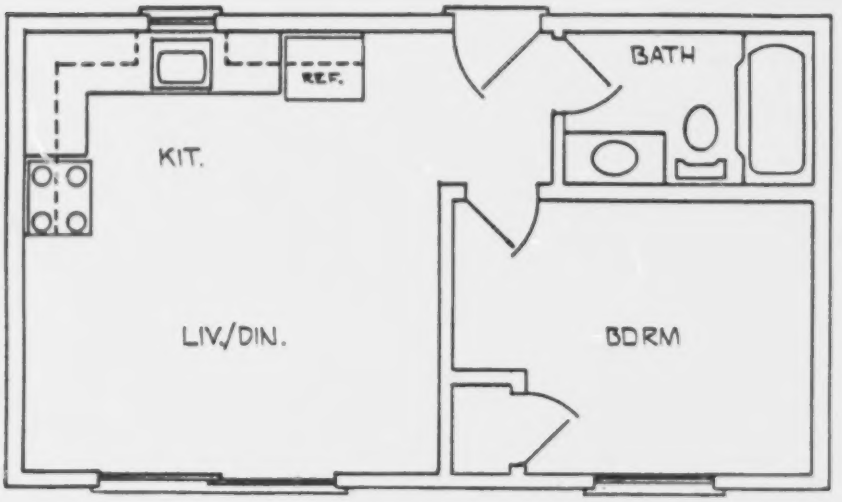
3. Now it is time to think about the living area. Since we are developing a floorplan for a vacation cottage, a formal living room and dining rooms with walls are not appropriate. Simply draw an outline on your graph paper where you would like the living area to be. Remember, your cottage does not need to be a perfect rectangle. Your cottage can be "L" shaped if you want. Refer to the following two floorplans.



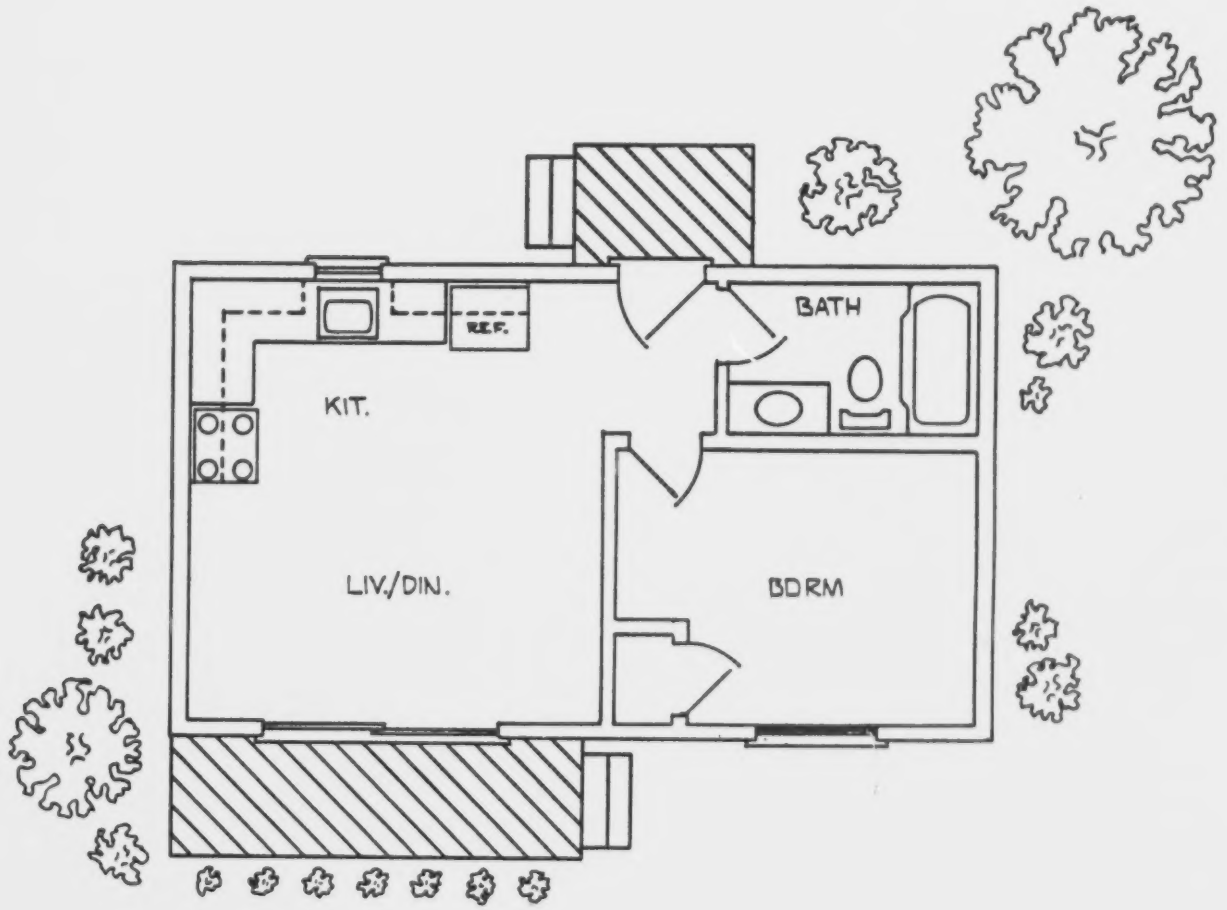


4. If you are satisfied with the positions of your templates, you can glue them down.

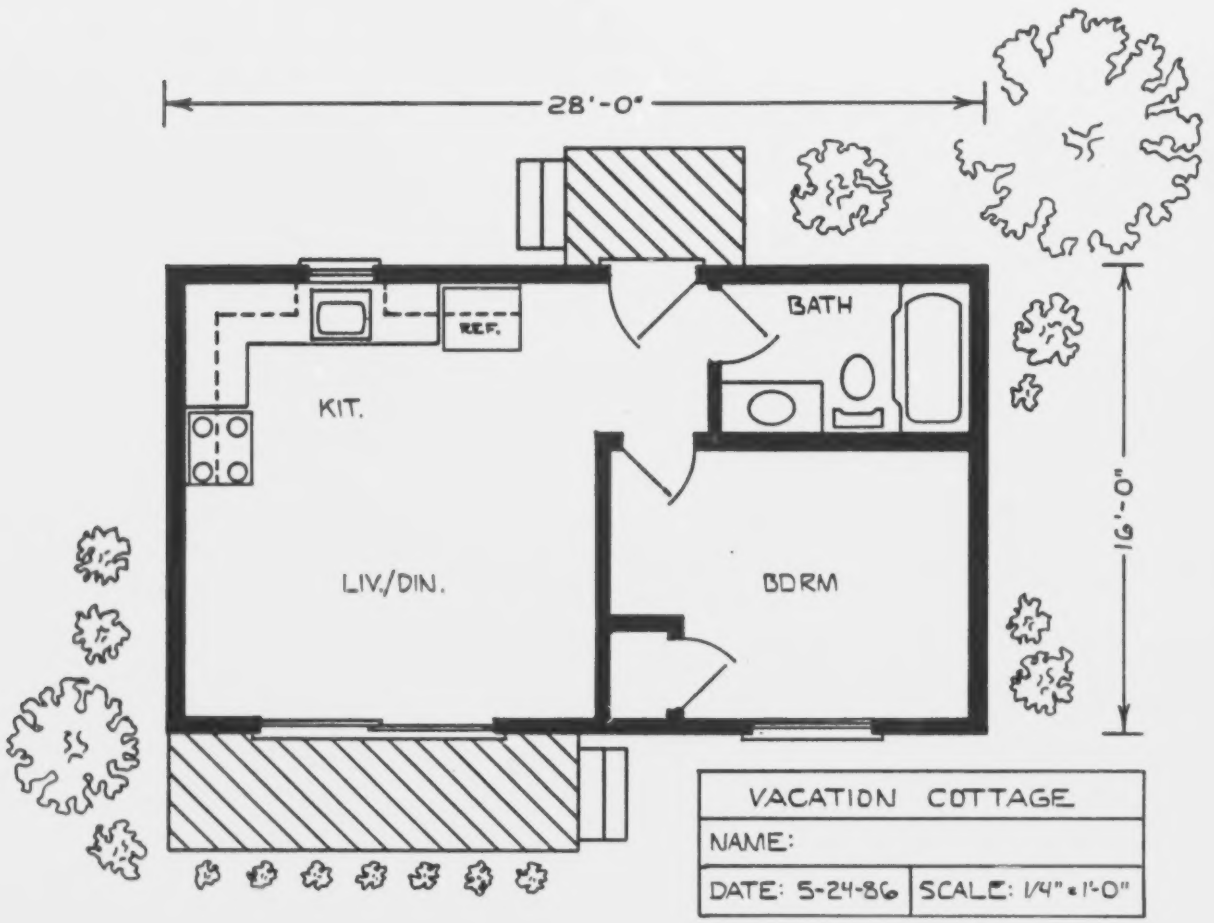
5. It is time to connect the walls, locate windows and locate doors. You can either cut window and door templates out and glue them on your graph paper or draw the symbols on your graph paper. Your cottage must have two exits and the bedroom must have two means of egress (a way out in case of a fire). Your two means of egress can be either two doors or a door and a window. See the illustration below.



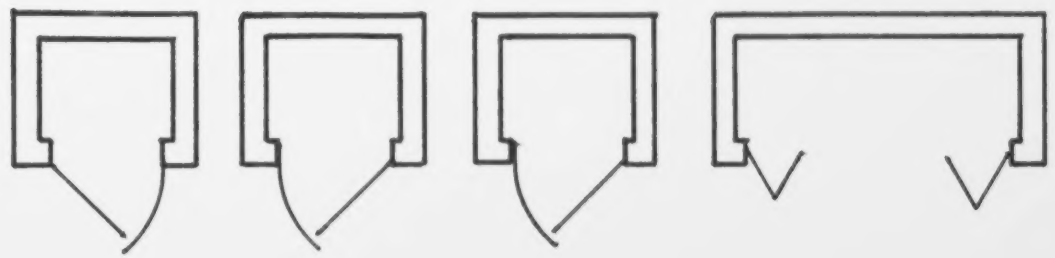
6. Vacation houses are built several feet above the ground. Therefore, each exit will need a deck with stairs. Choose and cut out the deck templates you want to use and glue them on your floorplan. While you are at it, why not landscape the yard? Locate trees (the large symbols) and bushes (the smaller symbols) so they do not interfere with the view from windows and doors. You can either use the templates provided or sketch the landscaping symbols on your floorplan. See the floorplan below.

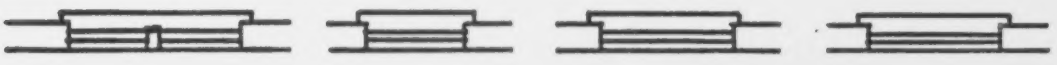


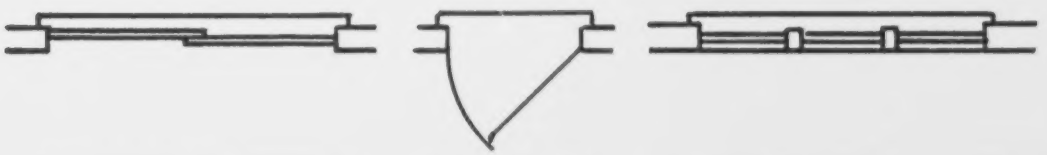
7. All your floorplan should need now is darkening in, documentation and dimensioning. Darken in the walls so they are all connected. Do not darken the windows and doors. Next, label all the rooms. Lastly, measure the length and width of your vacation cottage. Every 1/4" equals one foot. Label your dimensions in feet and inches (for example: 24' 0"). Refer to the illustration below.

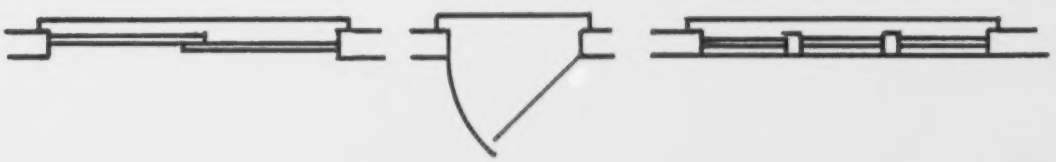


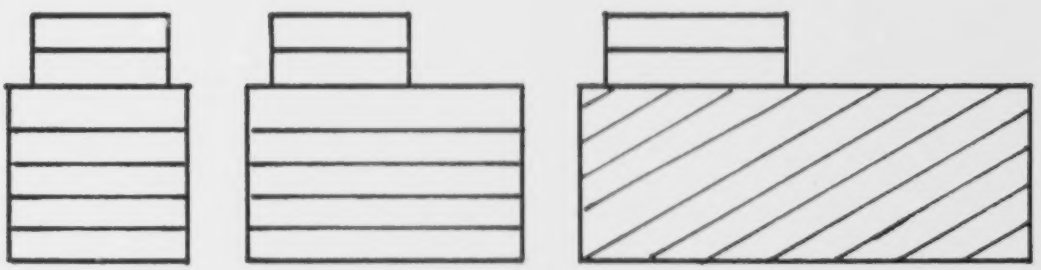
8. Draw a title block on your floorplan and write your name and the date in it. Make sure your drawing is free of mistakes before you turn it in for a grade.

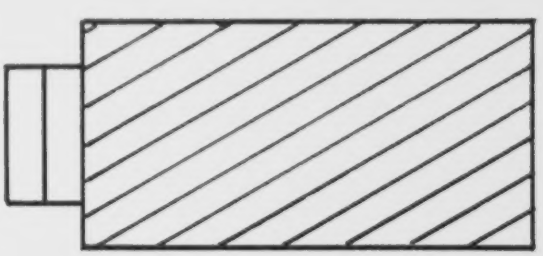












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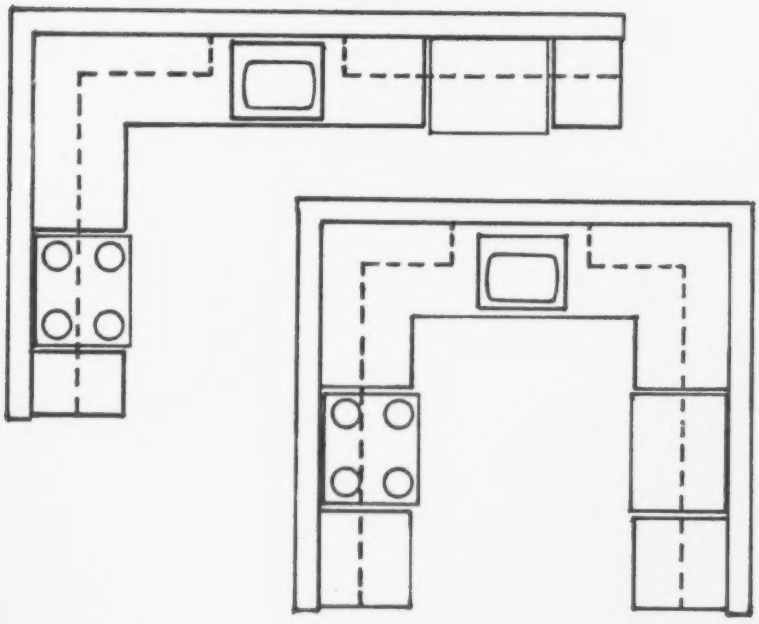

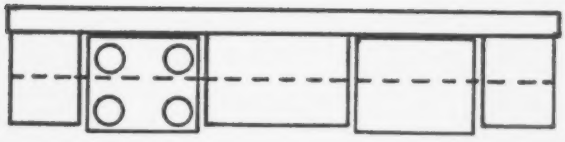

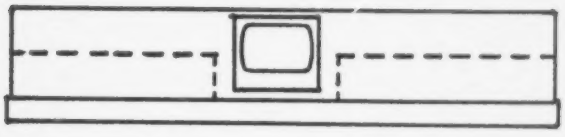

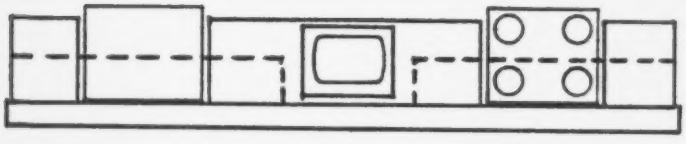

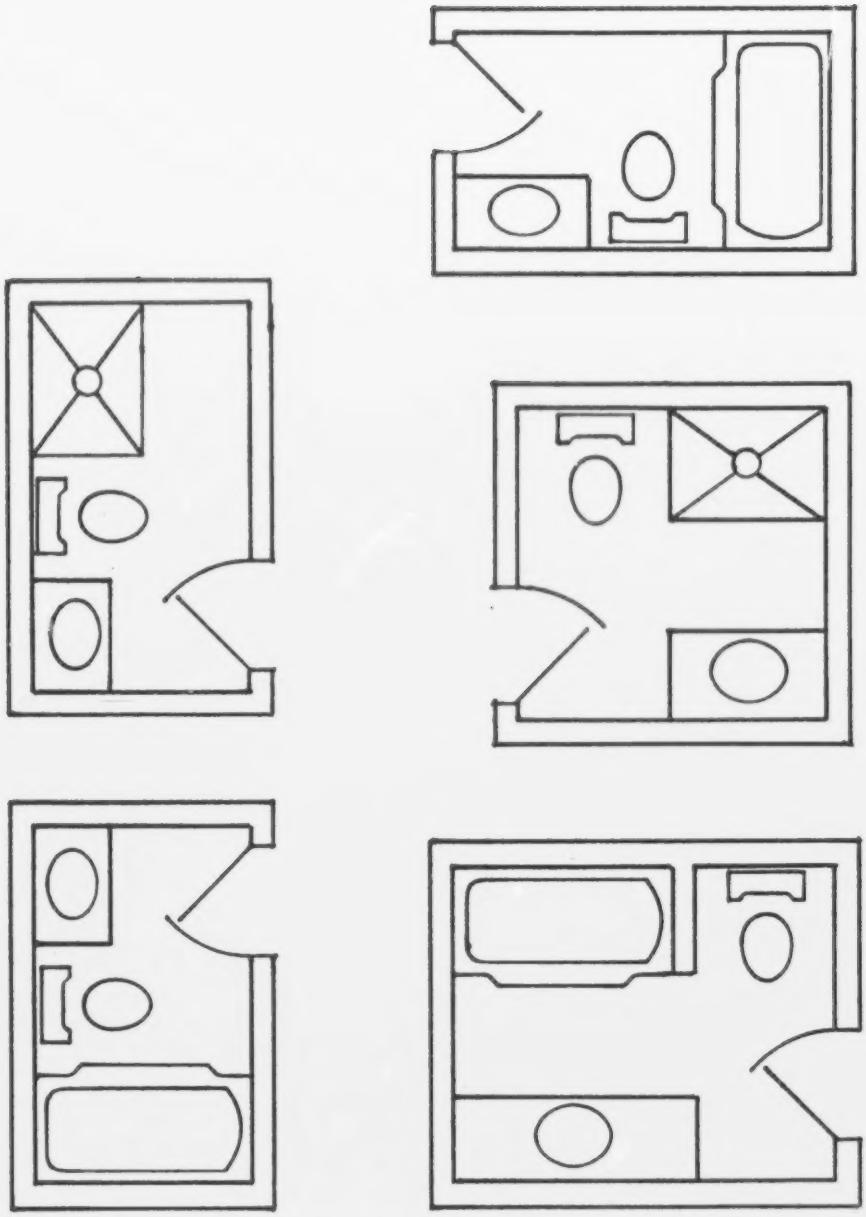

VACATION COTTAGE
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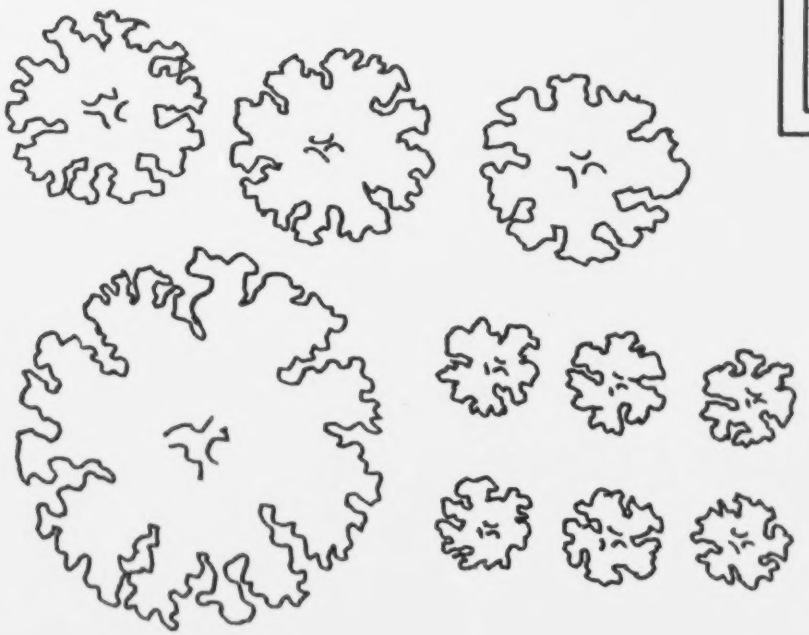


UNIT: Using the Language of Industry

LESSON 7: Reading an Architectural Floorplan

Objectives	Lesson Content	Learning Activities	Ref.
A. Following a discussion and demonstration, in a lab activity, students will read a floorplan and be able to: -determine how large the building is in square feet. -estimate the cost of the structure based on the number of square feet. -determine the types and number of windows and doors represented. -identify appliances and fixtures -identify problems and make design changes.	A. Reading a Floorplan 1. reading dimensions a. overall b. determining square feet c. estimating building cost 2. identifying means of egress a. windows b. doors 3. developing schedules a. windows b. doors 4. identifying features a. appliances b. fixtures 5. site features a. orientation b. landscaping 6. identifying design flaws	A. Teacher Guided Discussion 1. Discuss the importance of being able to read architectural floorplans. 2. Using OT #7-1, discuss and demonstrate how to read a floorplan. 3. Explain how to determine the size of the product and its specific features. 4. Explain how to identify specific features of the building. 5. Demonstrate how to estimate materials based on the floorplan. 6. Provide each student with HO #7-1 and make sure each student has paper and a pencil. 7. Have students read the floorplan and answer the questions provided. 8. Provide individual instruction and feedback as needed. 9. Collect and evaluate the lab activity.	TA #7-1: Reading an Architectural Floorplan OT #7-1: Floorplan HO #7-1: Reading an Architectural Floorplan

READING AN ARCHITECTURAL FLOORPLAN

Introduction:

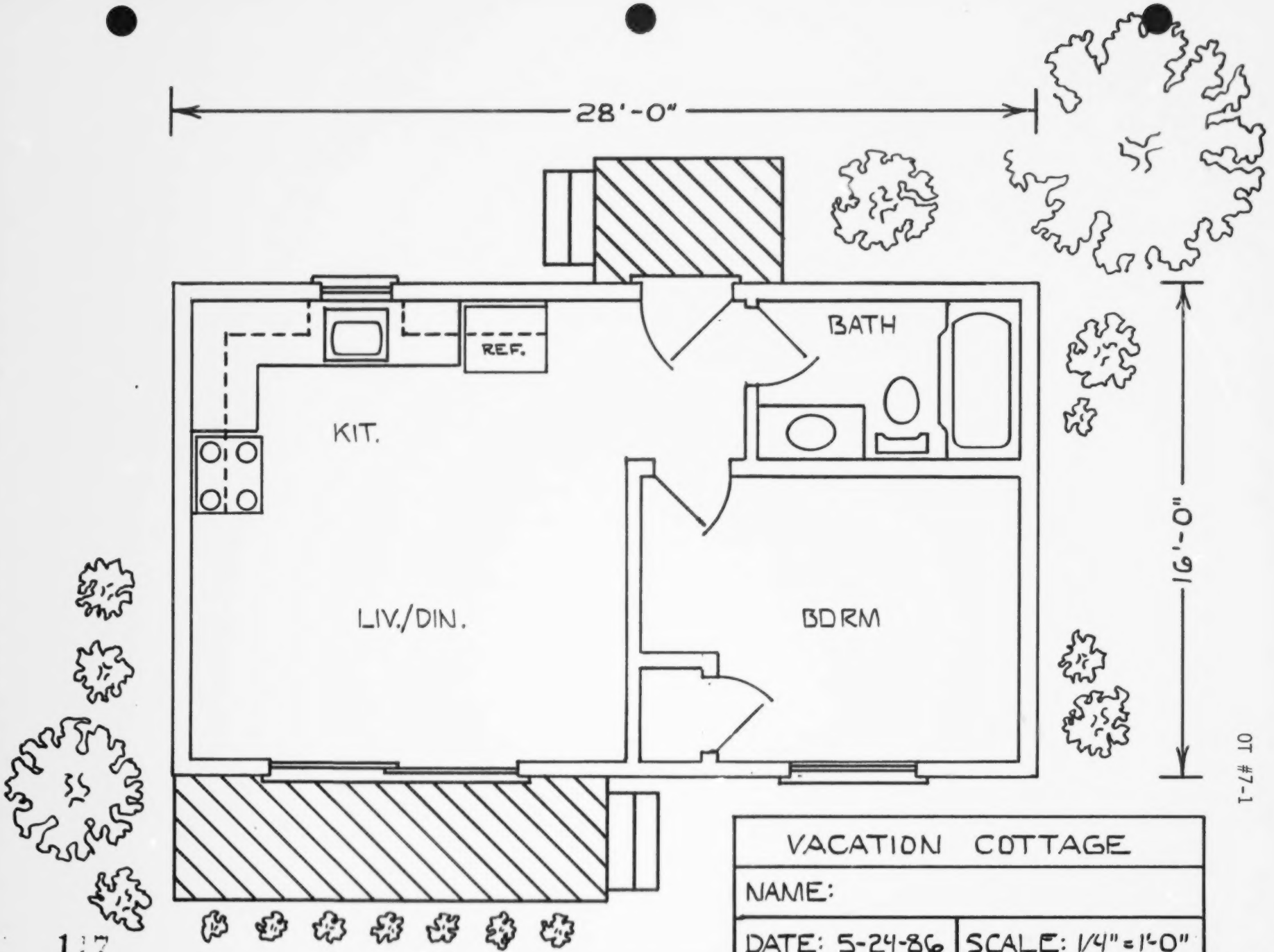
Encoding and transmitting technical information through drafting is only the beginning of the communication process. Students need to role play the receiving and decoding process to have a complete exploration experience in drafting communication. After most of your students have successfully developed a floorplan, introduce them to the concept of reading a floorplan. Discuss the relationship between draftspeople (senders) and the variety of people that will need to read drawings (receivers) in an industrial context. Emphasize the role of drafting as a communication tool in the construction industry. Provide examples of drafting communication that include personnel from a design, marketing, estimating, quality control, purchasing, production, consumer, and servicing context. It should be made clear to students that more people read drawings than make drawings in the construction industry.

How to Read a Multiview Drawing:

Using OT #7-1, discuss how the dimensions can be used to determine the area of a construction project. Using the area, explain how to make a rough estimate of the project's cost. Discuss how floorplan symbols can be used to identify specific features of the project. Explain and demonstrate how to develop a window and door schedule from a floorplan. Have students participate in the demonstration by answering questions.

Learning Activity:

Provide each student with HO #7-1. Have them read the plan and complete the lab sheet provided. Circulate around the classroom and provide individual instruction as needed. Before the end of class, tell students how they are doing as a group and make whatever general recommendations are necessary. Try to keep your feedback as positive as possible. Gathering information from a visual medium of this kind will be new to many of your students. Collect the lab sheets at the end of the class period. Evaluate the lab sheets in terms of the accuracy of the information gathered. When you return the labsheets, you may want to allow students to correct them on their own time and turn them in for a second evaluation.



VACATION COTTAGE	
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DATE: 5-24-86	SCALE: 1/4" = 1'-0"

OT #7-1

READING AN ARCHITECTURAL DRAWING

Introduction:

In the construction industry, there are many people who need to be able to read architectural drawings. Architectural drawings are such an important form of communication between architects, builders and their customers that they are considered legal documents. If there is a conflict between an architect, builder and a consumer, the drawings can be used in court to settle the dispute.

A floorplan is the most important drawing to be able to read. Designers use floorplans to present their ideas to the customer. The customer needs to be able to read the drawings and determine if the proposed building will meet their needs. A building inspector will read the floorplan to make sure the project follows local building codes (rules for building structures). If the design meets code, the inspector will issue a permit so the building can be built.

The builders will use the floorplan to estimate the cost of the project and order the materials needed for the project. When building begins, carpenters will use the floorplans to locate walls, windows and doors. Electricians will use them to locate electrical recepticles, lights, and switches. Plumbers use them to locate pipes and fixtures. The heating and air conditioning contractors use floorplans as a guide when sizing and installing climate control systems.

Remodeling projects, like building kitchens and room additions, often require floorplans for use during the planning and building processes. Floorplans are also often used by people in the service industry who install things like burgler alarms, smoke detectors, and sprinkler systems. Sales people use floorplans to communicate the features of their product. Their product could be a vacation home, camper, or mobile home. When you are looking for a specific store in a shopping mall, the directories are often in the form of floorplans.

Floorplans are commonly used communication tools. If you know how to read them, they can help you understand other people's ideas. In addition, if others can read your drawings, you can help them understand your ideas.

Reading Floorplans:

1. You are working for a company that builds vacation homes. One of your customers found a floorplan in a magazine and want a rough idea of what it will cost to

build. The first step in making a rough estimate is to determine the area of the building in square feet. Use the dimensions on the floorplan to figure the area. To figure the area, multiply the building's length by its width.

Length (feet) X Width (feet) = Area (square feet)

_____ X _____ = _____

The next step is to multiply the number of square feet by the cost per square feet. For our estimation, it will cost about 40 dollars per square feet to build the vacation house.

Square feet X cost per square foot = Building Cost

_____ sq. ft. X $40 = $ _____

It will cost about _____ dollars to build the vacation home.

2. Before you can build the house, you must make sure the plan meets building codes. One of the most important code requirements is that all the major rooms have two means of egress (ways out in case of fire). List the means of egress for each of the following rooms.

Living and Dining Rooms

1. _____

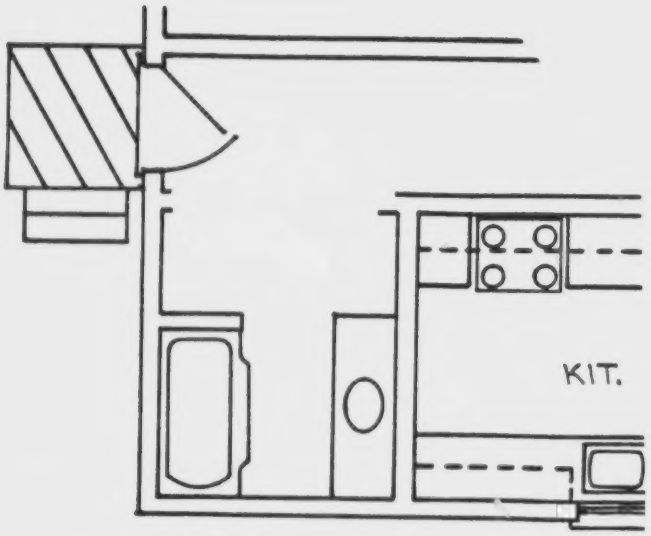
2. _____

Bedroom

1. _____

2. _____

3. Putting plumbing in outside walls can cause trouble in colder climates. It is difficult to insulate the plumbing and prevent it from freezing. Your customer's floorplan shows the water closet on an outside wall. On the plan below, sketch how the bathroom can be redesigned so the water closet is on an inside wall. You will have to relocate the door.



4. Before materials can be ordered, make a list of doors and windows. The lists that go with a floorplan are called "schedules." Using the floorplan as a guide, complete the following schedules (lists).

Door Schedule

Symbol	Type	Size	Quantity
1	EXTERIOR	3'-0" x 6'-8"	
2	INTERIOR	2'-6" x 6'-8"	
3	BI-FOILD	4'-0" x 6'-8"	
4	SLIDING GLASS	6'-0" x 6'-8"	

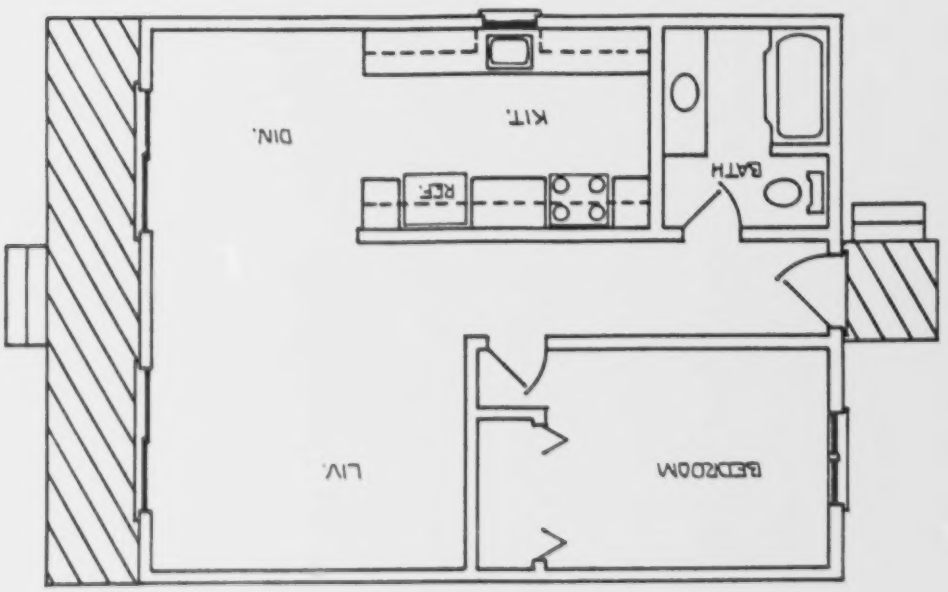
Window Schedule

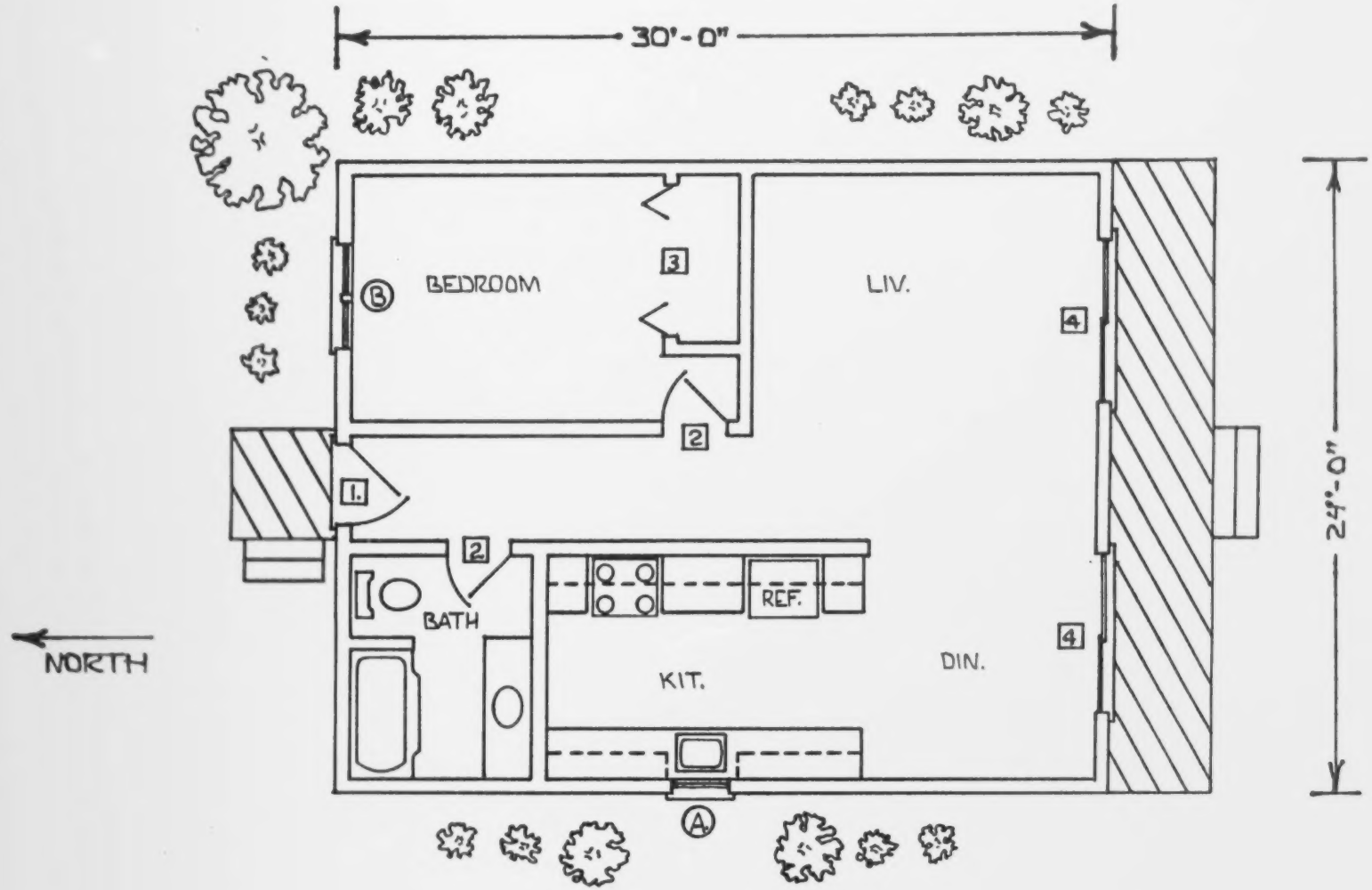
Symbol	Type	Size	Quantity
A	CASEMENT	R.O. = 2'-0" x 3'-0"	
B	CASEMENT	R.O = 4'-0" x 4'-0"	

5. In addition to doors and windows, kitchen appliances and bathroom fixtures need to be ordered. Read the floorplan and check the items that would need to be order off the list below.

Kitchen Appliances	Bathroom Fixtures
_____ Refrigerator	_____ Vanity Lavatories
_____ Dishwasher	_____ Shower Unit
_____ Range/Oven	_____ Bathtub
_____ Washer	_____ Water Closet
_____ Dryer	

6. Solar energy is available on the south side of a house for about six hours each day. The energy from the sun can be used to help heat and light the vacation home if it has windows facing south. Study your full size floorplan and determine which side of the house should be facing south to use solar energy. Label the side that should be facing south on the reduced floorplan below.





NAME 124	VACATION COTTAGE FLOORPLAN	DATE 125

HO #7-1 cont.

UNIT: Using the Language of Industry

LESSON 8: Sketching a Schematic Diagram

Objectives	Lesson Content	Learning Activities	Ref.
A. Following a discussion, students will be able to identify: -the definition of a schematic. -the applications for schematic diagrams -the basic symbols used in an electronic schematic. -the basic symbols used in a fluid power schematic.	A. Schematic Diagrams 1. schematic diagrams communicate: a. through symbols and single lines showing components in a circuit without concern for their real size, shape, or location. b. electrical and electronic systems c. hydraulic and pneumatic systems 2. applications a. assembly b. servicing 3. basic electrical symbols a. battery b. resistor c. conductor d. inductor e. antenna f. capacitor g. speaker h. transistor i. bulb j. switch 4. basic fluid power symbols a. pump b. electric motor c. conductor d. valve e. cyclinder f. reservoir	A. Teacher Guided Discussion 1. Using OT #8-1, discuss how difficult it would be to sketch electrical and/or fluid power componenets and circuits in detail. Explain how schematics are used to communicate technical information about electric/electronic and fluid power systems. 2. Discuss the applications for schematic diagrams. Have students list appliances that require a schematic diagram in their assembly or servicing. 3. Using OT #8-2, discuss common symbols used to represent components and circuits.	TA #8-1: Sketching a Schematic Diagram OT #8-1& 2: Circuits and Schematics OT #8-3 & 4: Schematic Symbols

B. Following a demonstration, in a lab activity, students will be able to accurately develop a schematic diagram from a pictorial representation of an electronic circuit.	B. Sketching Schematic Diagrams 1. circuit analysis 2. identifying, locating and sketching symbols 3. sketching the conductor path 4. documentation 5. darken in the drawing	B. Learning Activity 1. Demonstrate and discuss how to sketch a schematic diagram from a pictorial drawing. 2. Provide each student with HO #8-1. 3. Have students sketch a schematic diagram from the pictorial drawing provided. 4. Provide individual instruction as needed. 5. Before the end of the period, provide students with feedback regarding their sketching technique, use of symbols, and documentation. 6. Collect, evaluate, and/or display the sketches.	HO #8-1: Sketching a Schematic Diagram

SKETCHING A SCHEMATIC DIAGRAM

Introduction:

In the spirit of exploration, this unit includes a lesson on schematics. With the growth of electronics in industry and every day life, it is important for students to understand what schematics are, how they are drawn, and how they are used.

Explain why pictorial and multiview drawings have a limited communication value when it comes to electrical, electronic, and fluid power systems. Discuss how pictorial and multiview drawings could be used to show one component but not a network of components. A circuit board filled with electronic components could be a powerful visual aid when discussing the complexity of a system. Electronic servicing centers often discard complete circuit boards for the sake of efficiency. They should be happy to give you one.

Introduce students to the fact that a different type of drawing is needed to communicate technical information about electrical, electronic, and fluid power systems. Define schematic diagrams as "drawings that communicate through symbols and single lines showing component (parts) in a circuit (system) without concern for their size, shape, or location." Using OT #8-3 discuss the symbols commonly used in electrical, electronic, and fluid power schematic diagrams. Using OT #8-4, show students an example of a simple electronic and hydraulic schematic.

Discuss how much information is not included in the pictorial drawings (types of components and how they are connected). Discuss how simple the schematic diagrams look and how they really do not look like the actual product. Emphasize that the purpose of a schematic diagram is to illustrate the relationship between the components and how a system works, not how it looks.

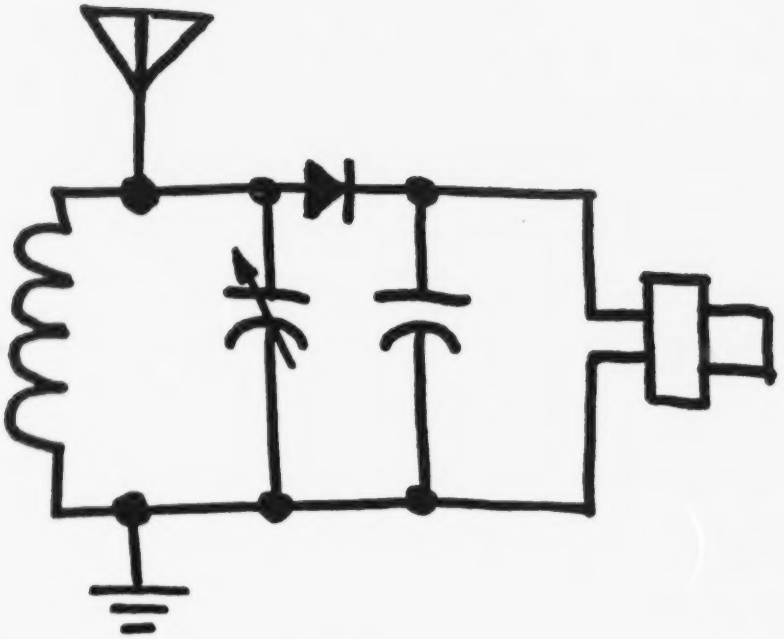
Discuss the two basic applications for schematic diagrams, assembly and servicing. Provide examples for each application. Have students list common appliances that require the use of schematics in the assembly or servicing. Their examples should inlcude things like stereos, televisions, video recorders, computers, and house wiring. Do not forget about fluid power systems. Common examples of fluid power systems include automatic washing machines, dishwashers, swimming pool filtering systems, and air conditioners. Automobiles and earth moving equipment are good sources for fluid power examples.

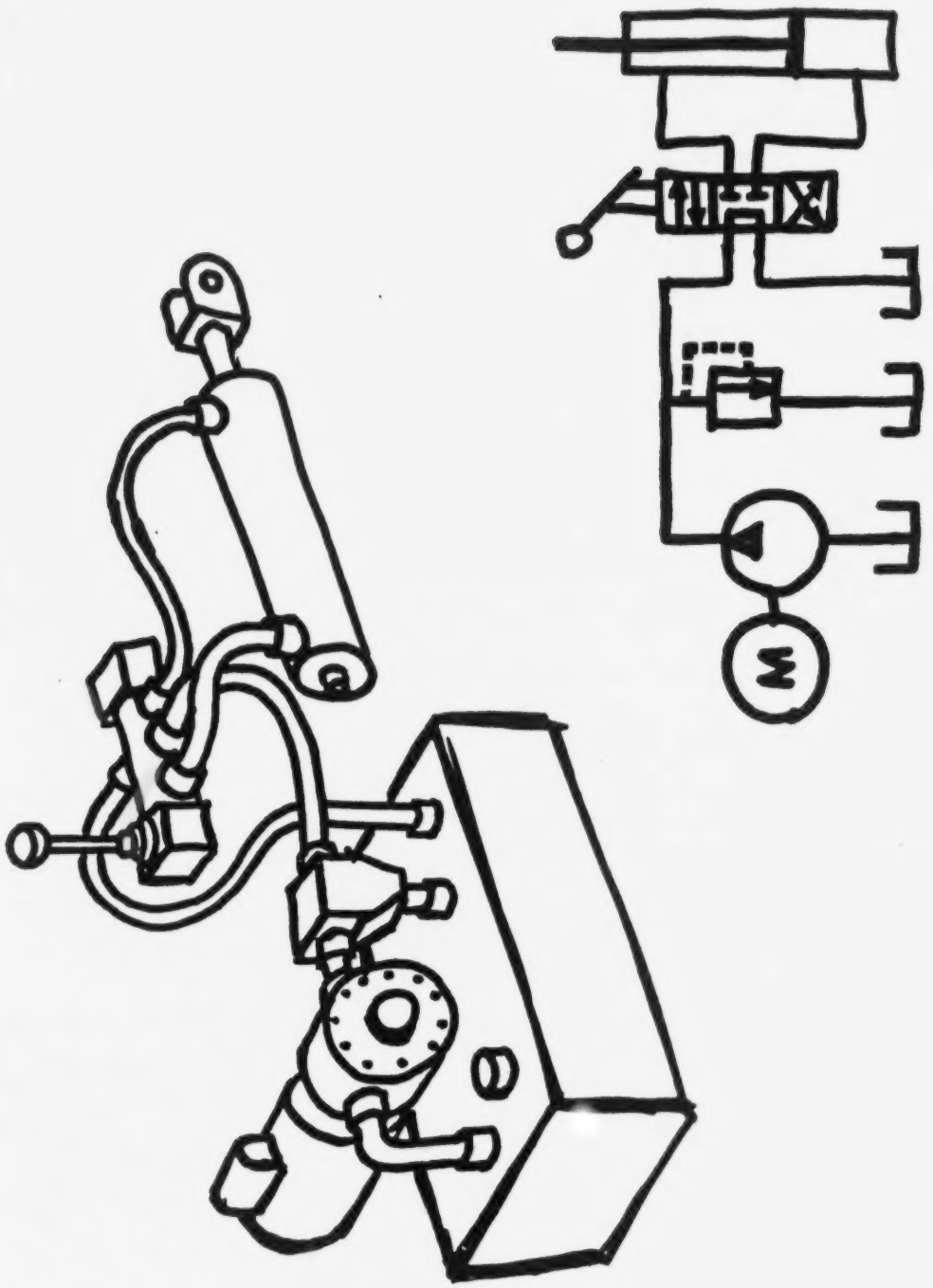
How to Sketch a Schematic Diagram:

Using the chalk board, demonstrate how to sketch a schematic for a crystal radio based on OT #8-1. Begin your demonstration by discussing how the circuit is put together (circuit analysis). Your second step should be to identify the symbols needed to represent each component. Sketch each symbol on the chalk board in a manner consistent with your circuit analysis. Discuss how the symbols can be oriented horizontally or vertically and when to make exceptions. Connect each componenet with its conductor path. Emphasize the importance of linear lines. Illustrate and discuss the difference between conductors crossing and a connection. Once the circuit has been drawn, demonstrate how to label each component and make a parts list. Lastly, darken in the schematic diagram. Provide students with an opportunity to ask questions before beginning the learning activity.

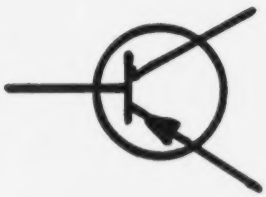
Learning Activity:

Provide each student with HO #8-1. Make sure each student has paper and a pencil. Your students will be more successful if they draw their sketches on graph paper or put a piece of graph paper under the plain paper as a guide. Have students begin sketching a schematic of the pictorial drawing provided. Circulate around the classroom and provide individual instruction as needed. Some of your students will have difficulty locating and connecting the symbols. Ask students questions about their schematics and provide clues when necessary. Before the end of the class, tell students how they are doing as a group and make whatever general recommendations necessary. Try to keep your feedback as positive as possible. Collect the drawings at the end of the class period. Evaluate the drawings in terms of their communication value. Try not to put too much emphasis on details that do not compromise basic communication. When the drawings are returned, allow students to correct them on their own time and turn them in for a second evaluation. You may want to display all or some of the schematic diagrams.

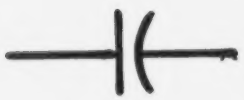




COIL, FERRI LOOPSTICK



TRANSISTOR

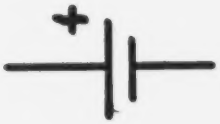


CAPACITOR

VARIABLE CAPACITOR

DIODE

RESISTOR



BATTERY

SWITCH

GROUND

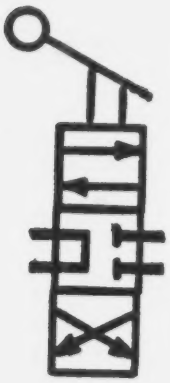
ANTENNA

EARPHONES

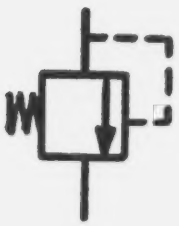
ELECTRIC MOTOR

HYDRAULIC PUMP

HYDRAULIC MOTOR



4-WAY, 3-POSITION VALVE



PRESSURE RELIEF VALVE

DOUBLE-ACTING CYLINDER

RESERVOIR (OIL TANK)

SKETCHING A SCHEMATIC DIAGRAM

Introduction:

Pictorial drawings can show us how something will look before it is made and Multiviews can show us how to make something through several views. But pictorial and multiview drawings have limited communication value when it comes to complex electrical, electronic or fluid power systems. Imagine having to draw every part inside of a stereo, a television, or a video recorder.

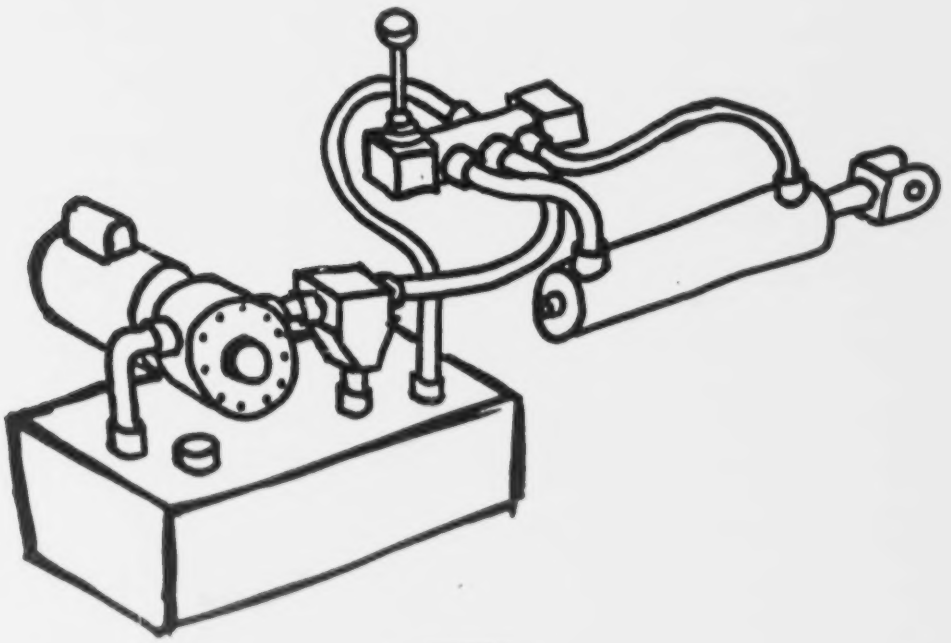
Electrical, electronic, or fluid power systems contain more than one component (part or device). Each separate component could be communicated through pictorial or multiview drawings. However, when several components are connected, a special type of drawing is needed to communicate the relationship between the components. This special type of drawing which communicates technical information about electrical, electronic, and fluid power systems is called a schematic diagrams.

Schematic diagrams illustrate the system through symbols. These simple symbols can be drawn quicker and easier than the actual components. Symbols are drawn the same whether the components are large or small. Single lines are used to show how components are connected. Schematics show how a system works more than how the system looks. The draftsperson can locate symbols anywhere on a drawing as long as the system drawn will work. When the product is actually made, it will not look anything like what will show in the drawing.

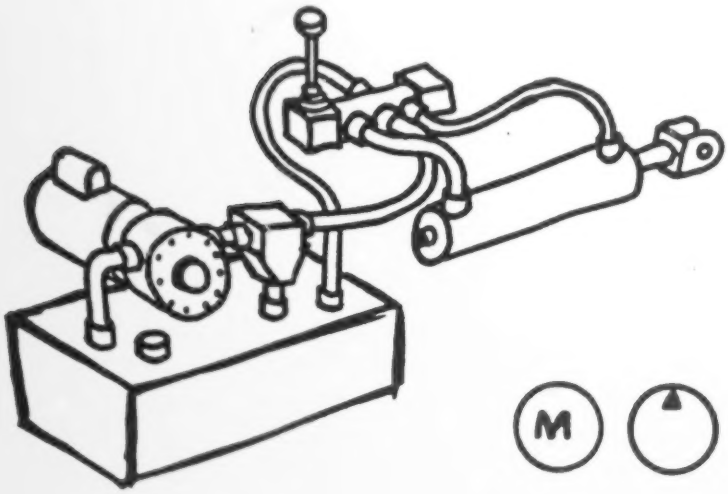
Schematics have two basic applications. The first application is assembly. Since schematics show the relationship between the components, they can be used to assemble an electrical, electronic or fluid power system. The second application is servicing. It is very difficult to understand how a circuit (system) works by looking at it. The systems are very complex and can have hundreds of parts. A schematic shows the system in a simpler form. Schematics help service people understand how a circuit works.

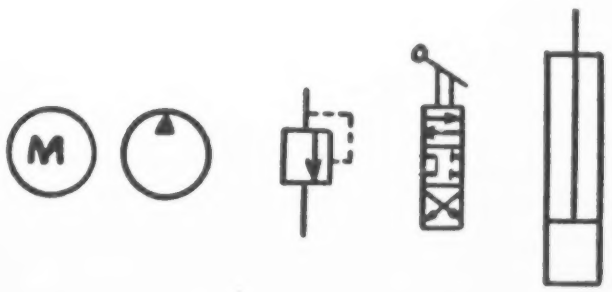
How to Sketch a Schematic Diagram:

1. The first step in developing a schematic diagram is to analyze the system. You need to know the names for the components and how they are connected. Shown below are pictorial drawings of an electronic and a hydraulic system.

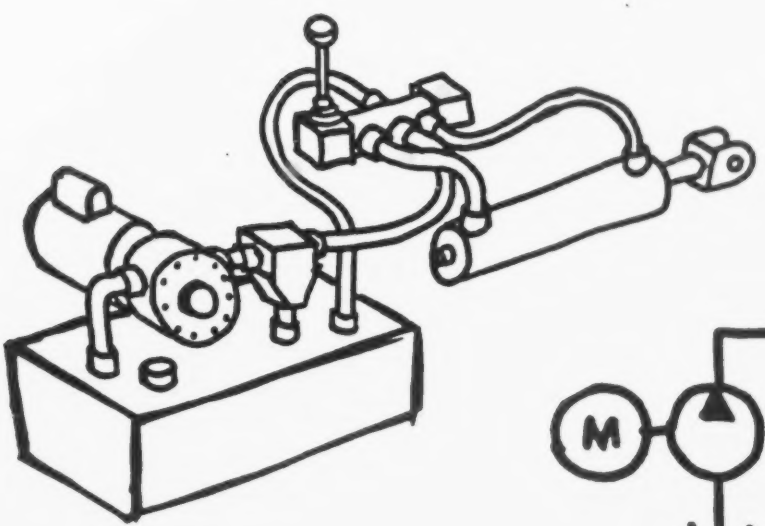


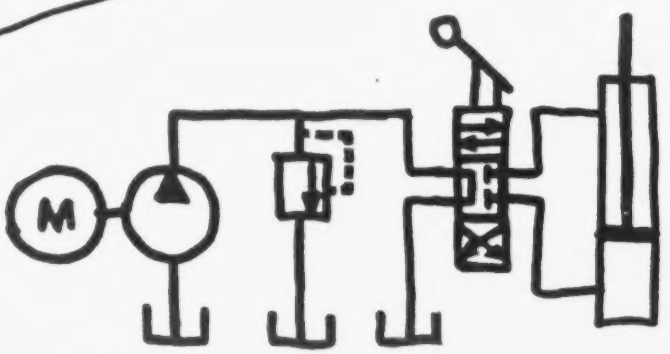
2. After you understand how the system is put together, you can begin laying out the schematic diagram. Identify the symbol used for each component and sketch it on your paper. When you locate the symbols on your paper, try not to crowd them in any one area. Space your symbols equal distances apart from one another. The distance between symbols should allow space for a label. You can either lay out the symbols horizontally or vertically. Look at the two examples below. Both have most of their symbols layed out vertically. You may need to lay out the components of your system horizontally.

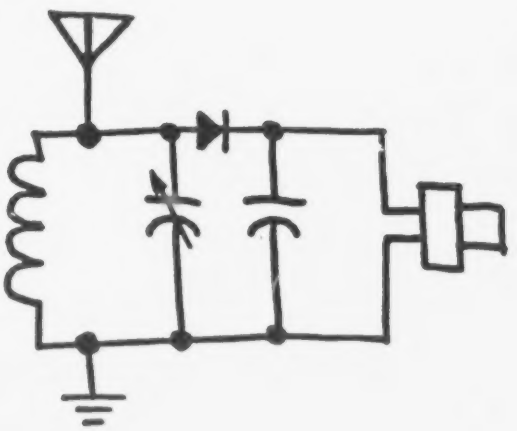




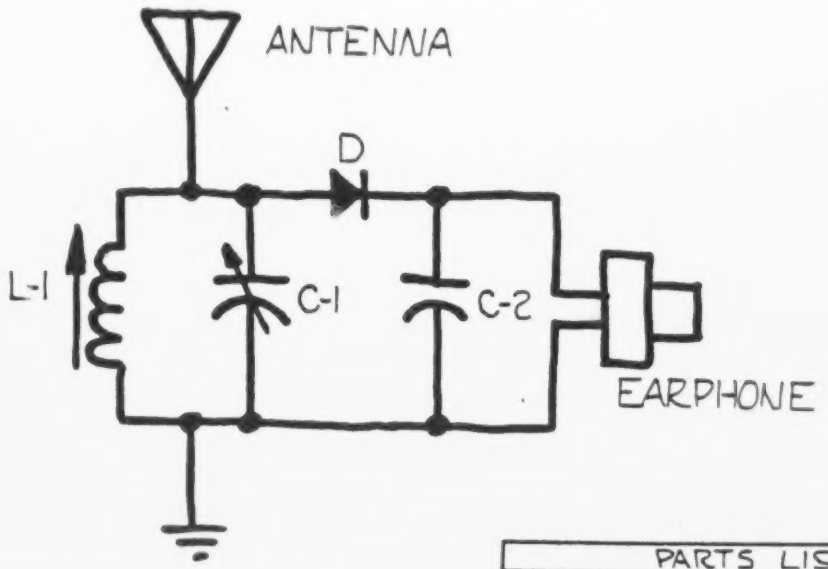
3. Once you have all your symbols layed out, it is time to connect them together. Use lines to show how pipes, hoses or wires connect each component together. Pick a symbol and trace the path from it to the next symbol. By drawing straight lines, show the traced path on your diagram. Continue tracing and drawing paths until all the symbols are linked together and the circuit will work. Look at the examples below. Only vertical and horizontal lines were used to connect the symbols. Wavy lines should not be used to show how components are connected.







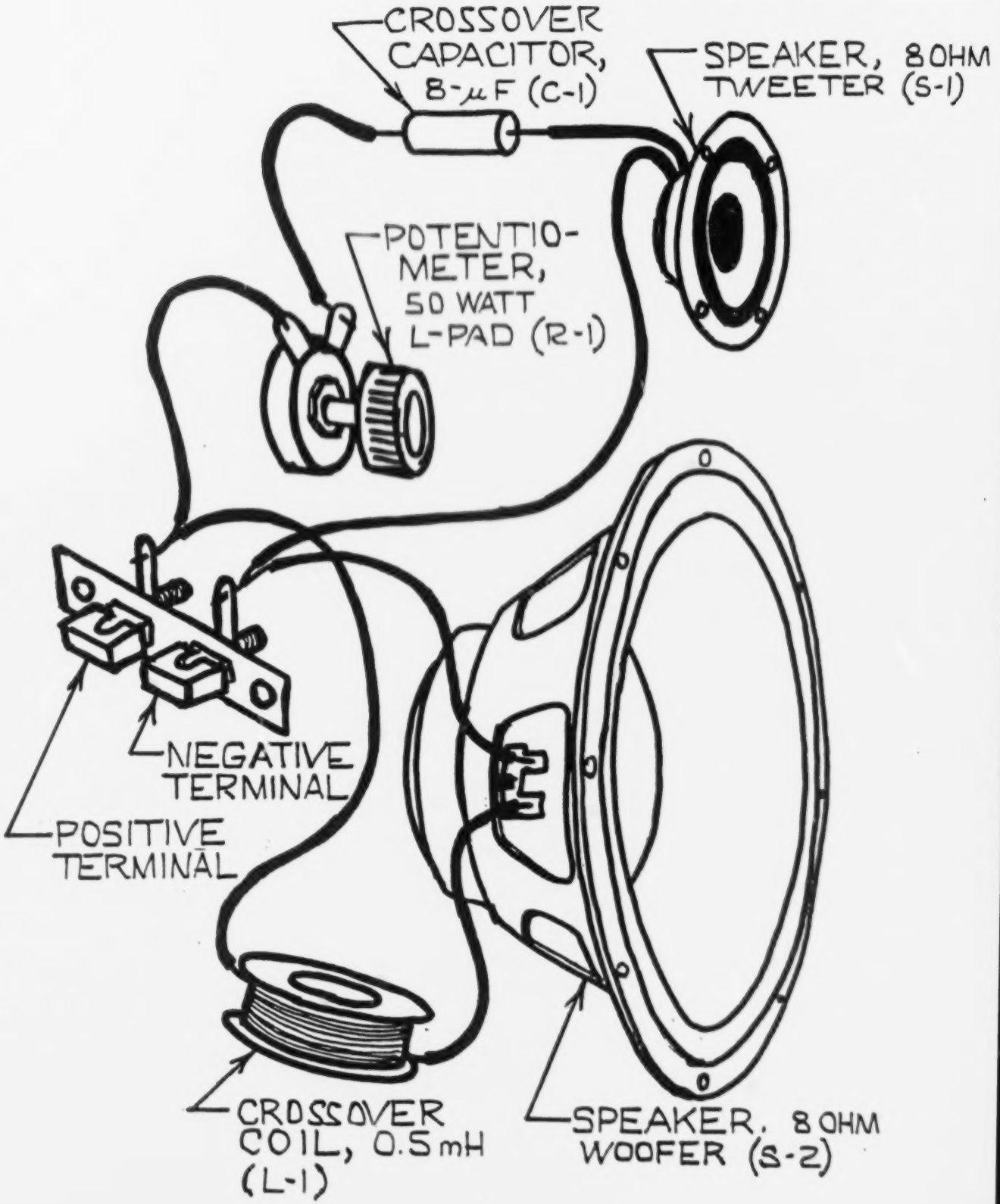
4. Your schematic diagram needs to show what size or type of component is being represented by each symbol. A simple label needs to be placed next to each symbol. Detailed information about each component is provided in a parts list. See the example below. Use the labels and information provided on your pictorial drawing to label your schematic and make a parts list.



PARTS LIST	
L-1	FERRI LOOPSTICIC
C-1	365 pF VARIABLE CAPACITOR
C-2	100 pF CERAMIC CAPACITOR
D	DIODE IN34

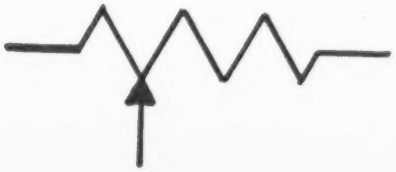
NAME: MIKE BROWN	CRYSTAL RADIO SCHEMATIC DIAGRAM	DATE: 6-2-86

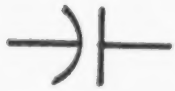
5. Your schematic diagram should communicate a circuit used to separate high and low sounds in a two-way speaker (a speaker containing a woofer and a tweeter). Erase the unwanted lines and darken in all the object lines. Put your name and the date in the title block. Make sure your drawing is free of mistakes before you turn it in for a grade.


CROSSOVER CAPACITOR, 8-μF (C-1)
SPEAKER, 8 OHM TWEETER (S-1)
POTENTIO-METER, 50 WATT L-PAD (R-1)
NEGATIVE TERMINAL
POSITIVE TERMINAL
CROSSOVER COIL, 0.5 mH (L-1)
SPEAKER, 8 OHM WOOFER (S-2)

ELECTRONIC SYMBOLS

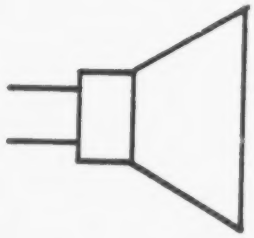
COIL

POTENTIOMETER 

CAPACITOR 

POSITIVE TERMINAL

NEGATIVE TERMINAL

SPEAKER 

CONDUCTOR PATH (WIRE)

CONDUCTOR CONNECTION

PARTS LIST	

HO #8-1

NAME 143

DATE 144

UNIT: Using the Language of Industry

LESSON 9: Reading a Schematic Diagram

Objectives	Lesson Content	Learning Activities	Ref.
A. Following a discussion and demonstration, in a lab activity, students will read a schematic diagram and be able to: -identify common electronic symbols. -determine relationships between given components by tracing conductor paths. -determine specific component specifications.	A. Reading a Schematic Diagram 1. identifying components a. resistor b. transistor c. capacitor (fixed and variable) d. battery e. diode f. inductor g. earphone h. switch 2. tracing conductor paths a. identifying connections b. determining relationships 3. completing a parts list a. component identification b. component labeling c. part description	A. Teacher Guided Discussion 1. Discuss the importance of being able to read a schematic diagram. 2. Using OT #9-1, discuss and demonstrate how to read a schematic diagram. 3. Explain how to identify components from their schematic symbol. 4. Explain how to determine the relationship between given components by tracing conductor paths. 5. Demonstrate how to use parts list to determine component specification. 6. Provide each student with HO #9-1 and make sure each student has paper and a pencil. 7. Have students read the schematic diagram and answer the questions provided. 8. Provide individual instruction and feedback as needed. 9. Collect and evaluate the lab activity.	TA #9-1: Reading a Schematic Diagram OT #9-1: Crystal Radio HO #9-1: Reading a Schematic Diagram

READING A SCHEMATIC DIAGRAM

Introduction:

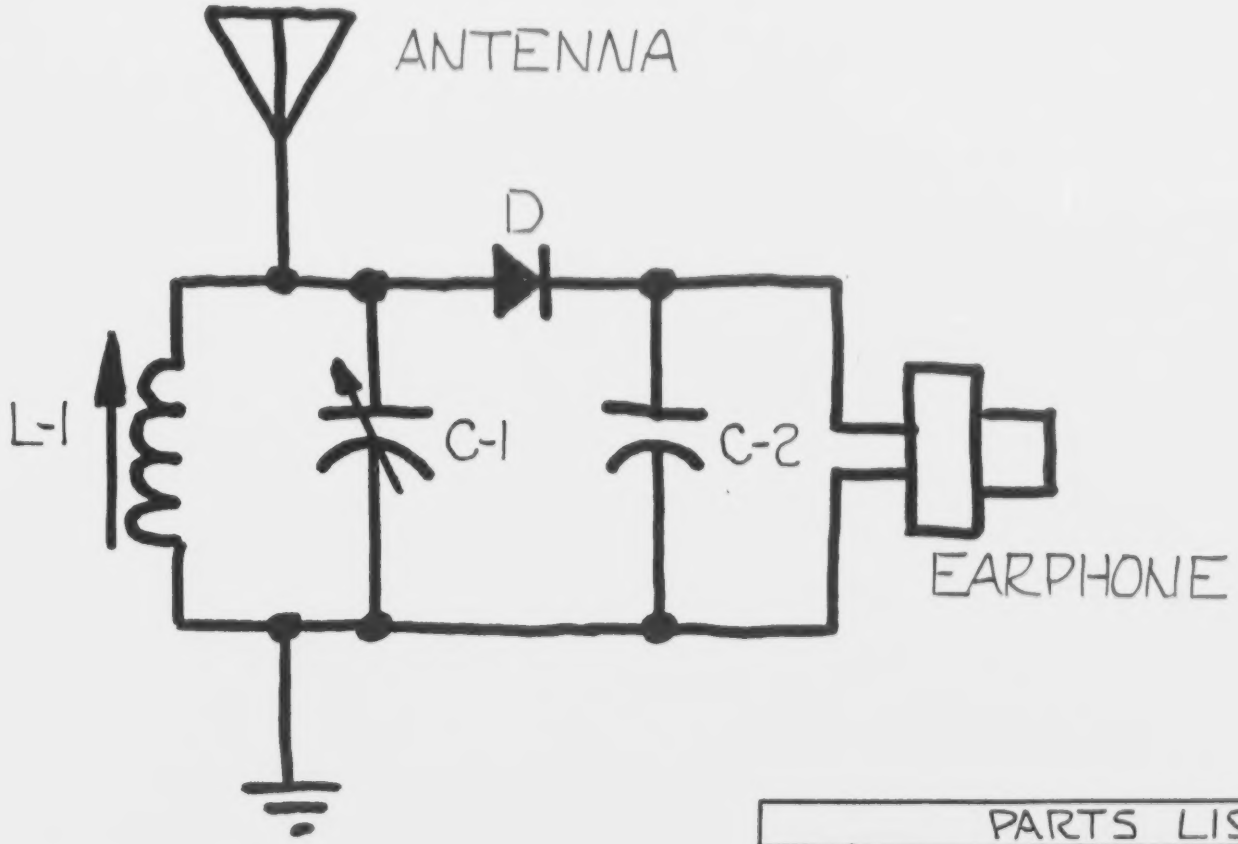
The role of electronics and fluid power systems in industry and every day life is growing. It is important that students understand how schematics can be used to communicate complex systems through simple symbols. After most of your students have successfully sketched a schematic diagram, introduce them to the concept of reading a schematic diagram. Review the relationship between drafters (senders) and the variety of people that will need to read drawings (receivers) in an industrial context. Emphasize the need to communicate complex systems through a simple communication tool in the electrical, electronic, and fluid power industries. Provide examples of how schematics are used to manufacture and service products and systems. Review the concept that more people read drawings than make drawings in industry.

How to Read a Schematic Diagram:

Using OT #9-1, discuss how the symbols represent a variety of components linked together in a system. Explain how relationships between components can be determined by tracing conductor paths. Discuss how the parts list can be used to determine specific information about each component in the schematic. Have students participate in the discussion by answering questions.

Learning Activity:

Provide each student with HO #9-1. Have them read the schematic diagram and complete the lab sheet provided. Circulate around the classroom and provide individual instruction as needed. Before the end of class, tell students how they are doing and make the necessary general recommendations. Try to keep your feedback as positive as possible. Gathering information from a schematic diagram is not easy. Your students may think they need to understand electronics to read a schematic. Collect the lab sheets in terms of the accuracy of the information gathered. When you return the lab sheets, you may want to allow students to correct them on their own time and turn them in for a second evaluation.



PARTS LIST	
L-1	FERRI LOOPSTICK
C-1	365 pF VARIABLE CAPACITOR
C-2	100 pF CERAMIC CAPACITOR
D	DIODE IN34

OT #9-1

148

NAME: MIKE BROWN	CRYSTAL RADIO SCHEMATIC DIAGRAM	DATE: 6-2-86

149

READING A SCHEMATIC DIAGRAM

Introduction:

The use of electronics and fluid power technology in industry is growing. Industry needs people who can design, manufacture, and service electronic and fluid power systems. Schematic diagrams are a common way of communicating technical information about electronic and fluid power systems.

When engineers and technicians need to design a new system, they sketch their ideas on paper. Schematic diagrams can be used to record and compare system design ideas. It is important that all the members of a design team understand how to read their team member's ideas.

Once a system has been designed, it must be built and tested. This is often the job of a technician who reads the design team's sketches. After the technician builds the system, he tests it and recommends changes in the design. These changes are recorded in the form of a schematic.

After designing and testing, the system is manufactured. Schematic diagrams are used to show production people how to assemble the electronic or fluid power systems. Diagrams communicate the locationof each part of a system -- some electronic systems require hundreds of tiny parts to be assembled.

Unfortunately, some systems will break down and need repair. Because it is difficult to understand how systems work by just looking at one, service people need to know how to read a schematic diagram to be able to fix them. An electronic system could include hundreds of components compacted in a small space. A fluid power system could be spread out over a long assembly line. Whether it is big or small, a system is easier to understand if you can read a schematic before trying to repair it.

You have all the components necessary to make the radio. Read the schematic diagram and answer the following assembly questions.

1. The diode and capacitor C-2 must be soldered between

   _____ and

   _____.

2. The Ferri Loopstick is located between the

   _____ and the ground.

3. One end of resistor R-1 is connected to capacitor C-2 and transistor TR-1.

   The other end of the resistor is connected to

   _____ and capacitor

   _____.

4. The leads of transistor TR-1 are connected to resistor R-1, capacitor C-1,

   and _____.

5. You do not want to get capacitor C-2 and capacitor C-3 mixed up. What size

   capacitor is used in location C-2 and C-3?

   C-2 is a _____ capicitor.

   C-3 is a _____ capicitor.

6. What size battery does this radio need?

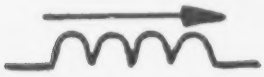
   B-2 is a _____ volt battery

7. What is special about capacitor C-1?

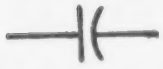
   C-1 is a _____ capacitor

Reading a Schematic Diagram:

1. You are interested in electronics and want to build a radio. You found a schematic for a simple radio in an electronics magazine. Before you go to the electronics store, you need to check the parts list and make sure it includes all the components needed to build the radio. Read the parts list carefully. Using the symbol table below, finish labeling the symbols on your schematic so they match the parts list.


COIL, FERRI LOOPSTICK

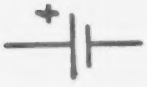
TRANSISTOR


CAPACITOR

VARIABLE CAPACITOR

DIODE

RESISTOR

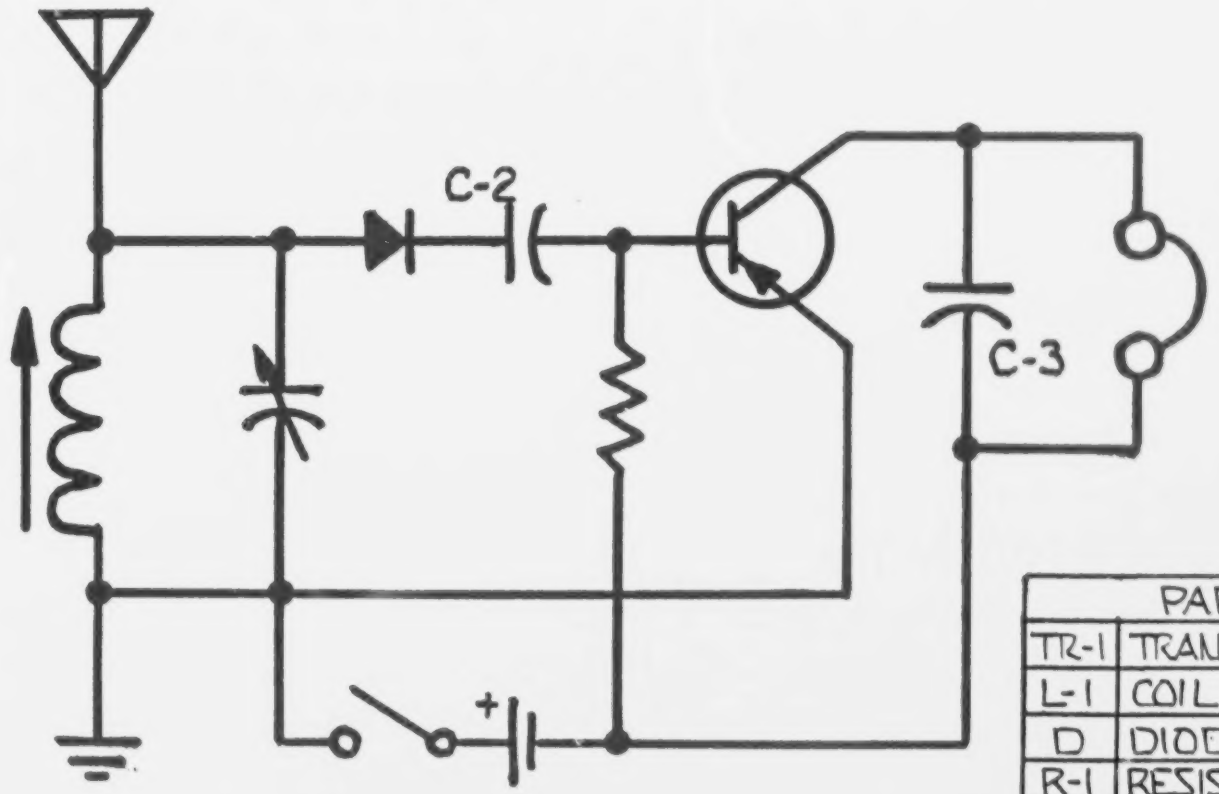

BATTERY

SWITCH

GROUND

ANTENNA

EARPHONES



PARTS LIST	
TR-1	TRANSISTOR, 2N107
L-1	COIL, FERRI LOOPSTICK
D	DIODE, 1N295
R-1	RESISTOR. 470 KΩ
S-1	SWITCH, SP
B-1	BATTERY, 9 VOLTS
E-1	EARPHONE
C-1	VARIABLE CAP., 20-365 pf
C-2	CAPACITOR, .02 μf DISK
C-3	CAPACITOR, .1 μf PAPER

HO #9-1 cont.

NAME: MIKE BROWN 153	TRANSISTOR RADIO SCHEMATIC DIAGRAM	DATE: 6-3-86 154

UNIT: Using the Language of Industry

LESSON 10: Sketching Graphs and Charts

Objectives	Lesson Content	Learning Activities	Ref.
A. Following a discussion, students will be able to identify: -the purpose of graphs and charts. -the three basic types of graphs and their applications. -the two basic types of charts and their applications.	A. Graphs and Charts 1. are pictorial ways of showing information. a. graphs: numeric information b. charts: organizations or processes 2. basic types of graphs a. line graphs b. bar graphs c. pie graphs 3. basic types of charts a. flow charts b. organizational charts 4. applications for graphs and charts a. line graphs: show trends or changes b. bar graphs: show quantities for comparison c. pie graphs: show parts of a whole for comparison d. flow charts: show the steps in a process e. organizational charts: show positions in an organization	A. Teacher Guided Discussion 1. Using OT #10-1, discuss how boring information is in table or list form. 2. Using OT #10-2, discuss how graphs and charts make information more interesting and easier to understand. 3. Using OT #10-3, discuss the basic types of graphs and charts and explain the applications for each.	TA #10-1: Sketching Graphs and Charts OT #10-1: Table OT #10-2: Graphs OT #10-3: Chart

B. Following a demonstration in a lab activity, students will be able to: -develop a line, bar, and pie graph illustrating given numeric data. -develop a flow chart illustrating a given process. -develop an organization chart illustrating the positions within an organization.	B. Drawing Graphs and Charts 1. analyzing the data or information 2. identifying the appropriate type of graph or chart 3. layout the basic shape for the graph or chart 4. illustrate the data or information 5. documentation 6. check and darken in the drawing	B. Learning Activity 1. Demonstrate and discuss how to illustrate information in the form of a graph and/or chart. 2. Provide each student with HO #10-1 3. Have students sketch graphs and/or charts from the data and information provided. 4. Provide individual instruction as needed. 5. Before the end of the period, provide students with feedback regarding the communication value of their graphs and/or charts. 6. Collect, evaluate, and/or display the sketches.	HO #10-1: Sketching Graphs and Charts

SKETCHING GRAPHS AND CHARTS

Introduction:

Graphs and charts are powerful ways of communicating technical information in school, in business, and in industry. Discuss how boring information can be in list or table form. Explain how people can understand technical information better if it is in graph or chart form. The newspaper can be an excellent source for examples of graphs and charts. Have your students cut out and display the graphs and charts found in the newspaper. Discuss the three basic types of graphs and explain the advantages of each. You could have students display the graphs they find in terms of their basic type. Discuss how charts are used in education, in business and in industry. Discuss the two basic types and their applications.

How to Sketch Graphs and Charts:

Using the examples provided or on the chalk board, demonstrate how to develop a line graph, bar graph, and a pie graph. Emphasize the need to layout, scale and document the graph so it is in proportion with the data and looks good. Tell students that a graph that looks good will communicate better. Demonstrate the formula for converting percentages into degrees for the pie graphs. Before you discuss charts, make sure your students do not have any questions about graphs.

Using the organizational structure of your school, demonstrate on the chalk board how to develop an organization chart. Explain why some positions are located at different levels. Provide example of who would fit into given parts of the organization structure.

Demonstrate how the steps in a process can be illustrated through a flow chart. You can use a simple project as an example. Show how to illustrate the steps in making the project. Use different shapes for different kinds of operations. Provide students with an opportunity to ask questions.

Learning Activity:

Provide each student with HO #10-1. Make sure each student has paper and a pencil. You will need to provide several protractors for the students to use and share when drawing their pie graphs. Your students will be more successful if they draw their sketches on graph paper or put a piece of graph paper under their plain paper as a guide.

Have students begin sketching their graph(s) and/or chart(s). Your students do not need to draw every type of graph and chart. If time is limited, you may want your students to sketch one type of graph and/or chart from the materials provided.

Circulate around the classroom and provide individual instruction as needed. Some of your students may have difficulty locating their data on the graphs. Watch for graphs that are too big or too small. Before the end of class, tell students how they are doing as a group and make whatever general recommendations are necessary. Try to keep your feedback as positive as possible. Collect the drawings at the end of the class period. Evaluate the drawings in terms of their communication value. Try not to put too much emphasis on details that do not compromise basic communication. When the drawings are returned, allow students to correct their drawings on their own time and turn them in for a second evaluation. You may want to display all or some of the graphs and/or charts.

STORE SALES

SEPT. $153,000

OCT. $159,000

NOV. $281,000

DEC. $334,000

JAN. $116,000

PRODUCT SALES:

Stereos 25%

Video Recorders 38%

Televisions 15%

Computers 22%

SALES STAFF:

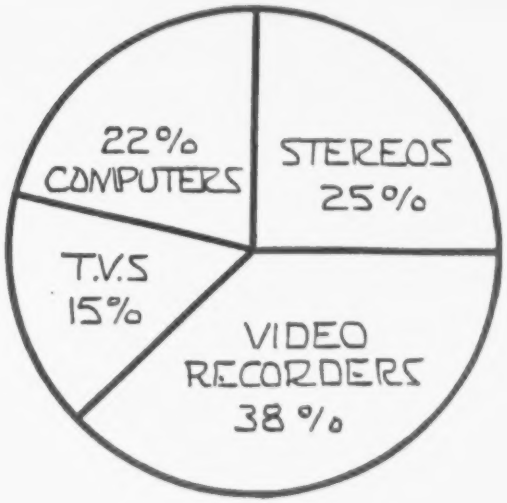
Sue $3750

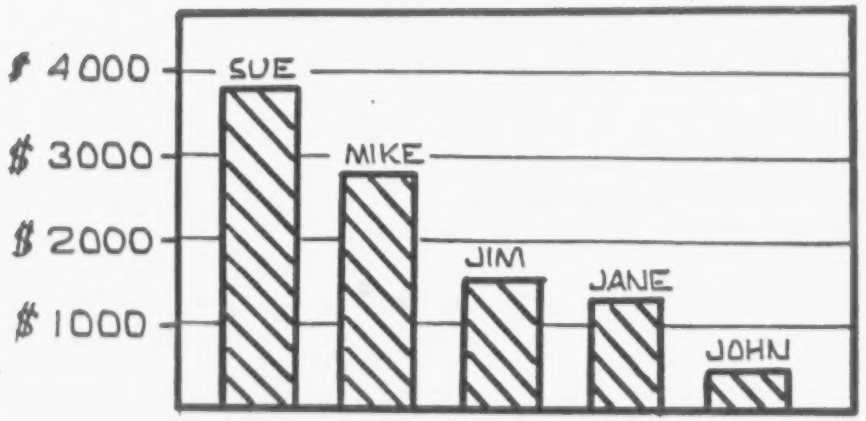
Mike $2849

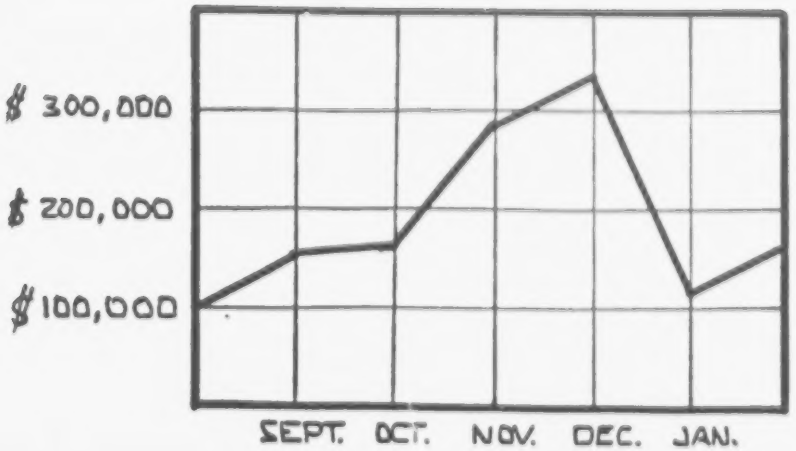
Jim $1610

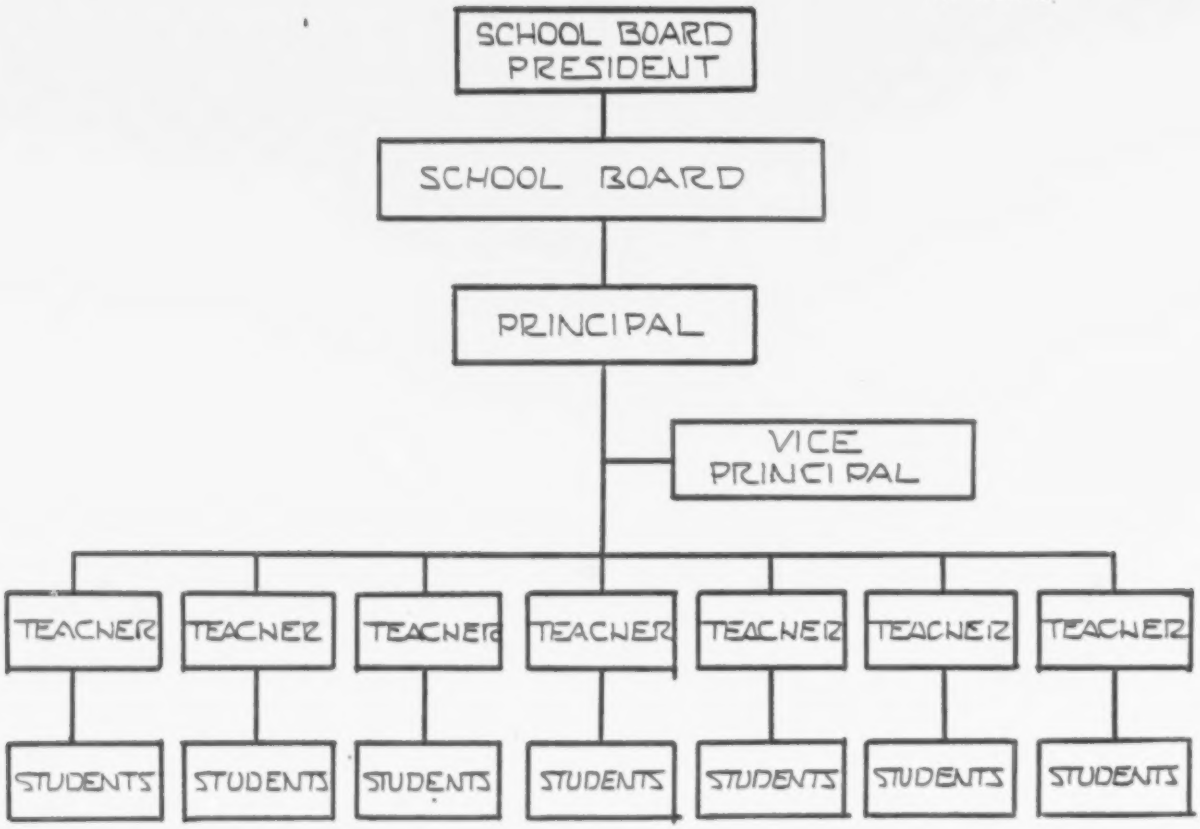
Jane $1421

John $511


22%
COMPUTERS
STEREOS
25%
T.V.S
15%
VIDEO
RECORDERS
38%


$ 4000
$ 3000
$ 2000
$ 1000
SUE
MIKE
JIM
JANE
JOHN


$ 300,000
$ 200,000
$ 100,000
SEPT.
OCT.
NOV.
DEC.
JAN.


SCHOOL BOARD PRESIDENT
SCHOOL BOARD
PRINCIPAL
VICE PRINCIPAL
TEACHER
TEACHER
TEACHER
TEACHER
TEACHER
TEACHER
TEACHER
STUDENTS
STUDENTS
STUDENTS
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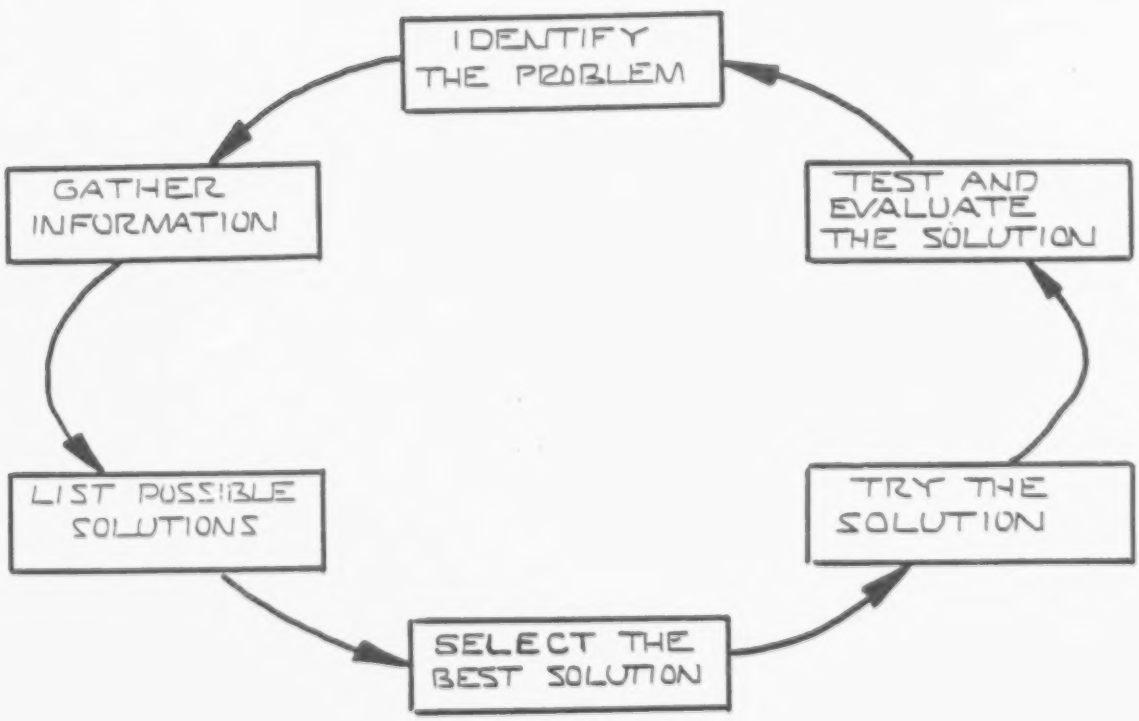

IDENTIFY THE PROBLEM
GATHER INFORMATION
LIST POSSIBLE SOLUTIONS
SELECT THE BEST SOLUTION
TRY THE SOLUTION
TEST AND EVALUATE THE SOLUTION

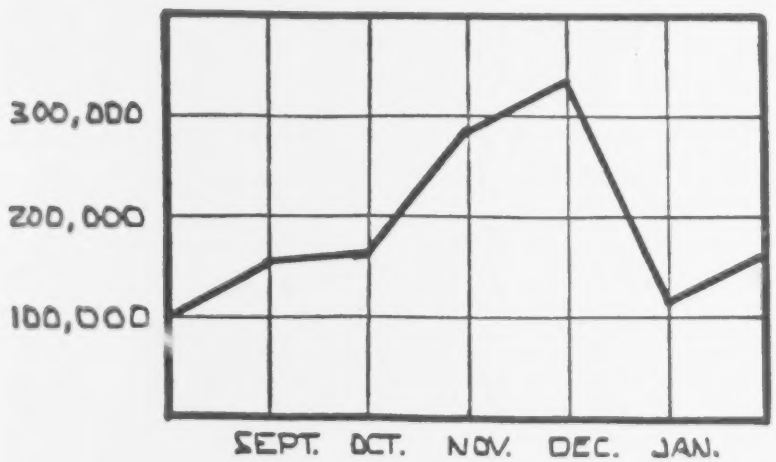
SKETCHING GRAPHS AND CHARTS

Introduction:

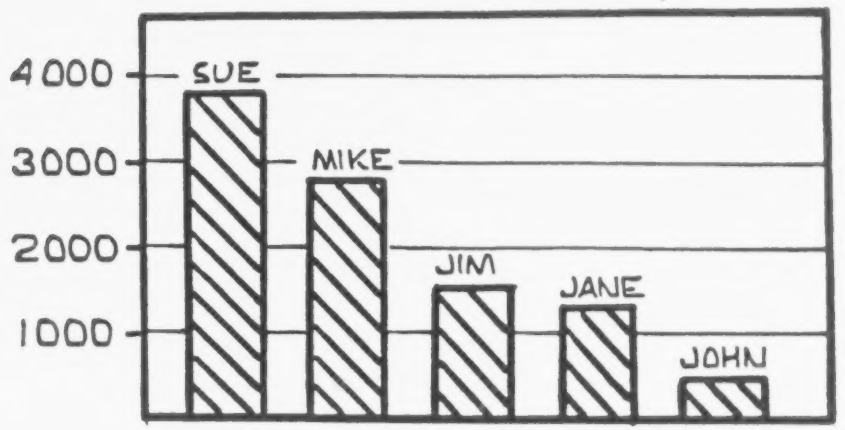
Pictorial and multiview drawings are used to communicate information about a shape and architectural drawings communicate information about a structure. Schematics communicate information about a system. Just like these drawings, graphs and charts are used to convert technical information into pictures. Graphs communicate information that is in the form of numbers. Charts communicate information about an organization or a process.

Graphs and charts are powerful communication tools in business and industry. Putting technical information in the form of a graph or chart makes it more interesting and easier to understand.

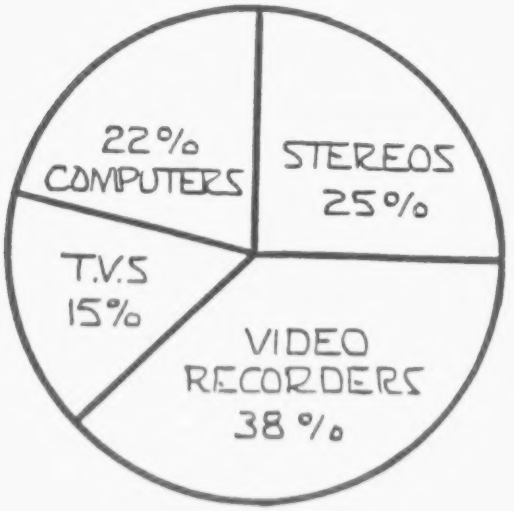
The three basic types of graphs are line graphs, bar graphs, and pie graphs. Line graphs are typically used to show trends or changes over time. The line graph below shows how store sales went up during November and December and dropped in January. Do you think Christmas had anything to do with the jump in sales?



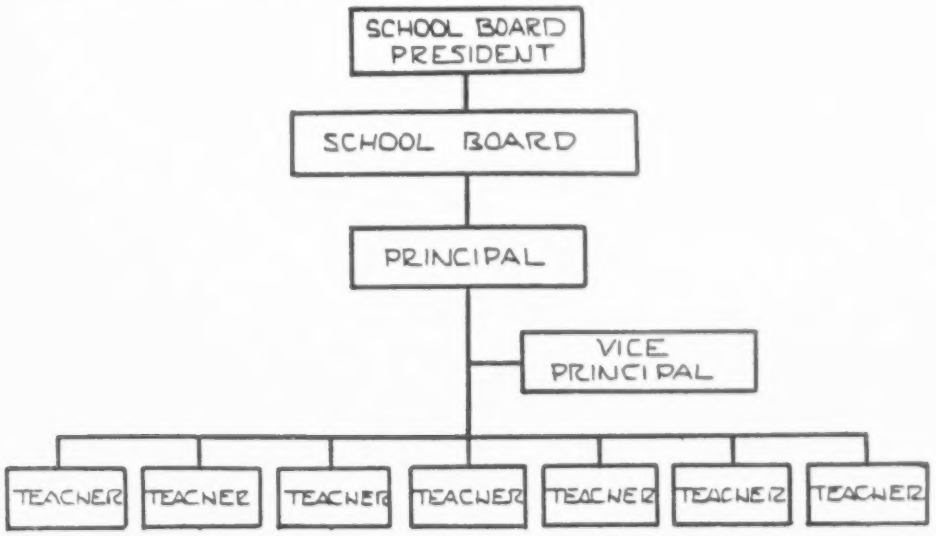
Bar graphs are often used to make comparisons. The bar graph below shows the amount of sales made by each member of the store's sales staff. Who do you think will be fired if he/she does not sell more products?



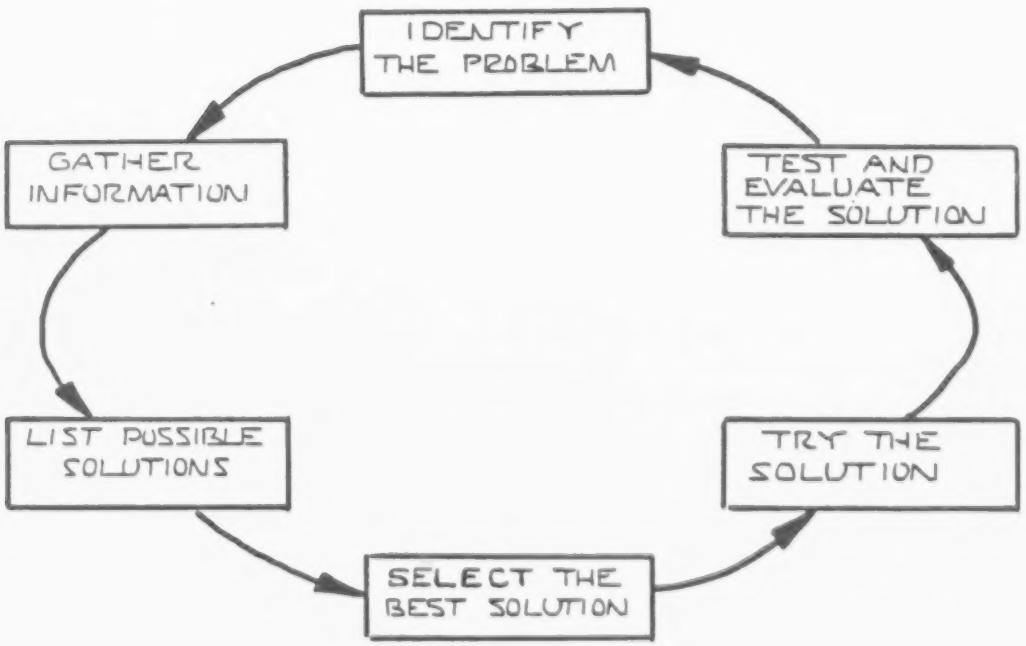
Pie graphs are used to show the parts of something in comparison to the whole (for example, how big a piece of pie is in comparison to the whole pie). The pie graph below shows how much of the store's December sales (whole) were gained from certain products (parts). What was the most popular Christmas gift purchased from this store?



Charts can also communicate complex information quickly and easily. The two basic types of charts are flow charts and organization charts. Flow charts show a process and organizational charts show positions. The chart below shows a typical organization structure for a school. Who has the highest position in a school?



Flow charts show the steps in a process in graphic form. The flow chart below shows the steps in solving a problem. According to this chart, does the process ever end?



Sketching a Line Graph

1. The first step in sketching a graph is to study the data (numbers). Data is generally listed on a table. The data you will graph is on the table below.

Average Cost of a New American Car

Model Year	Average Cost
1970	$3,708
1975	$5,084
1980	$7,609
1985	$11,629

(Motor Vehicle Manufacturers Assoc. of the United States, Inc.)

2. On your graph paper, you need to draw horizontal and vertical axes. See the example. Graphs look the best when the horizontal and the vertical axes are about the same length.

3. The next step is to put a scale on each of the axes. Spread the scale along the full length of each axis. See the example.

4. Next step is to plot (locate) the data on the graph. The scales will be used to plot the points on the graph. Each point will represent a number from the table. Read the table and plot each point on the graph. See the example.

5. Once all the points have been located, connect each point with a line. See the example.

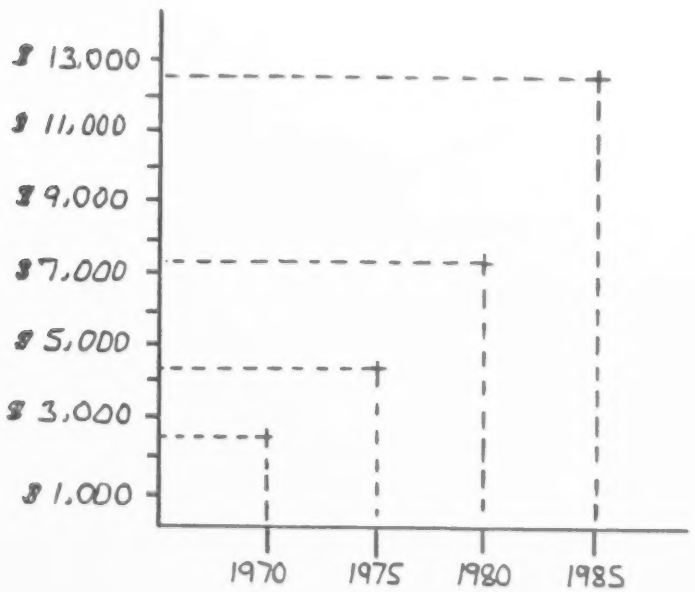
6. The next step in sketching your graph is documentation. The horizontal and the vertical axes have to be labeled. You may also want to include the data on your graph if the numbers are important. See the example.

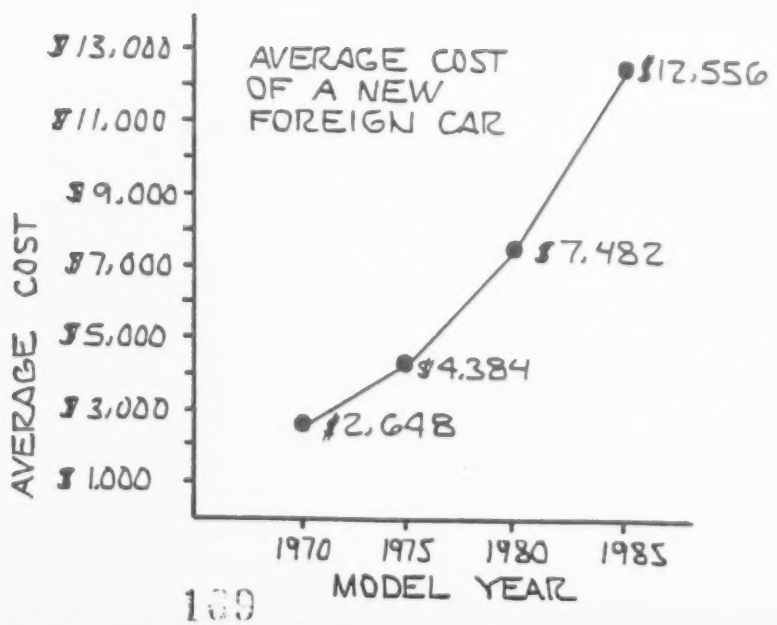
EXAMPLE:

Average Cost of a New Foreign Car

Model Year	Average Cost
1970	$2,648
1975	$4,384
1980	$7,482
1985	$12,556

(Motor Vehicle Manufacturers Assoc. of the United States, Inc.)





Sketching a Bar Graph:

1. Bar graphs are a lot like line graphs. The first step is to study the data in the table. The data for your graph is listed in the table below.

Grand Slam Sluggers

Player (Team)	Number of Grand Slams
Dave Kingman (Oakland)	15
Eddie Murray (Baltimore)	14
George Foster (N.Y. Mets)	13
Reggie Jackson (California	11
Don Baylor (Boston)	11

(Elias Sports Bureau, 1986)

2. You need to draw a horizontal and vertical axis on your graph paper just like you did before. Remember, your graphs will look the best if the horizontal and the vertical axis are about the same length.

3. Put a scale along the length of each of the axes.

4. Draw each bar needed to represent the data. Do not worry about their height yet. Draw each bar lightly so you can erase unwanted lines later.

5. Plot (locate) the top of each bar using the data in the table. Use scales to determine bar height. Each bar will represent a number from the table.

6. After you have drawn each bar, erase unwanted lines and darken in the graph.

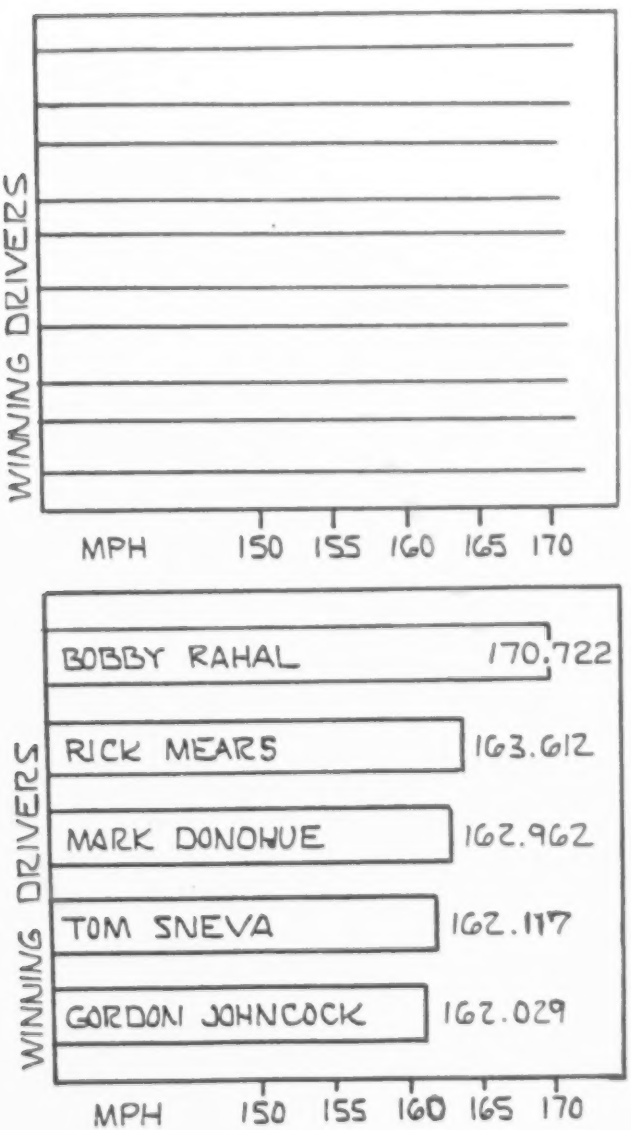
7. The last step is documentation. Label the horizontal and the vertical axes. Write in the data on top of each bar if you want to.

EXAMPLE:

Indianapolis 500 Speed Records

Winning Driver	MPH
Bobby Rahal (1986)	170.722
Rick Mears (1984)	163.612
Mark Donohue (1972)	162.962
Tom Sneva (1983)	162.1776
Gordon Johncock(1982)	162.029

(USA TODAY research, 1986)



Sketching a Pie Graph:

1. The first step in developing a pie graph is to study the data in the table. The data you will graph is listed below.

Energy Usage in the U.S.

Applications	Percent
Transportation	25%
Industrial	37%
Commercial	16%
Residential	22%

(U.S. Dept. of Energy, 1980)

2. Draw a circle about 5 inches in diameter for your graph. See the example.

3. The next step is to cut the pie into pieces. Read the first number listed on your table. This number represents a percent. On your graph, 1 percent is equal to 3.6 degrees. Multiply the number from your table by 3.6 degrees. This will give you the number of degrees for the first slice of the pie (or graph). Using a protractor, lay out the first segment (part). See the example. Repeat this process for each number listed on your table until the graph is complete.

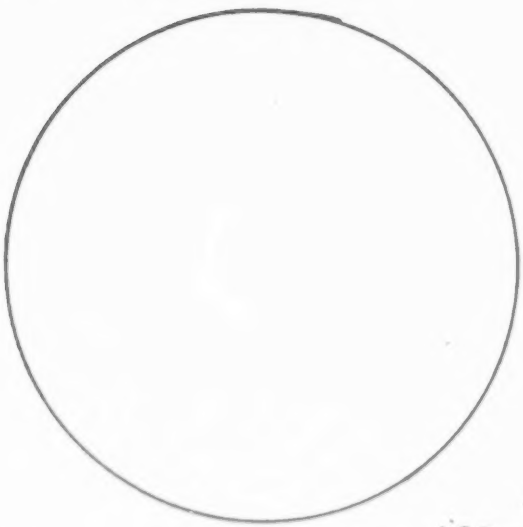
4. Erase all unwanted lines and darken your graph.

5. The last step is to document the graph. Label each segment (part) and write in the percent.

EXAMPLE: Who Is Handling Our Long Distance Calls

Long Distance Co.	Percent
AT&T	75.7%
MCI	7.4%
Gte/US Telecom	4.3%
Allnet/Lexitel	1.3%

(The Yankee Group, 1986)



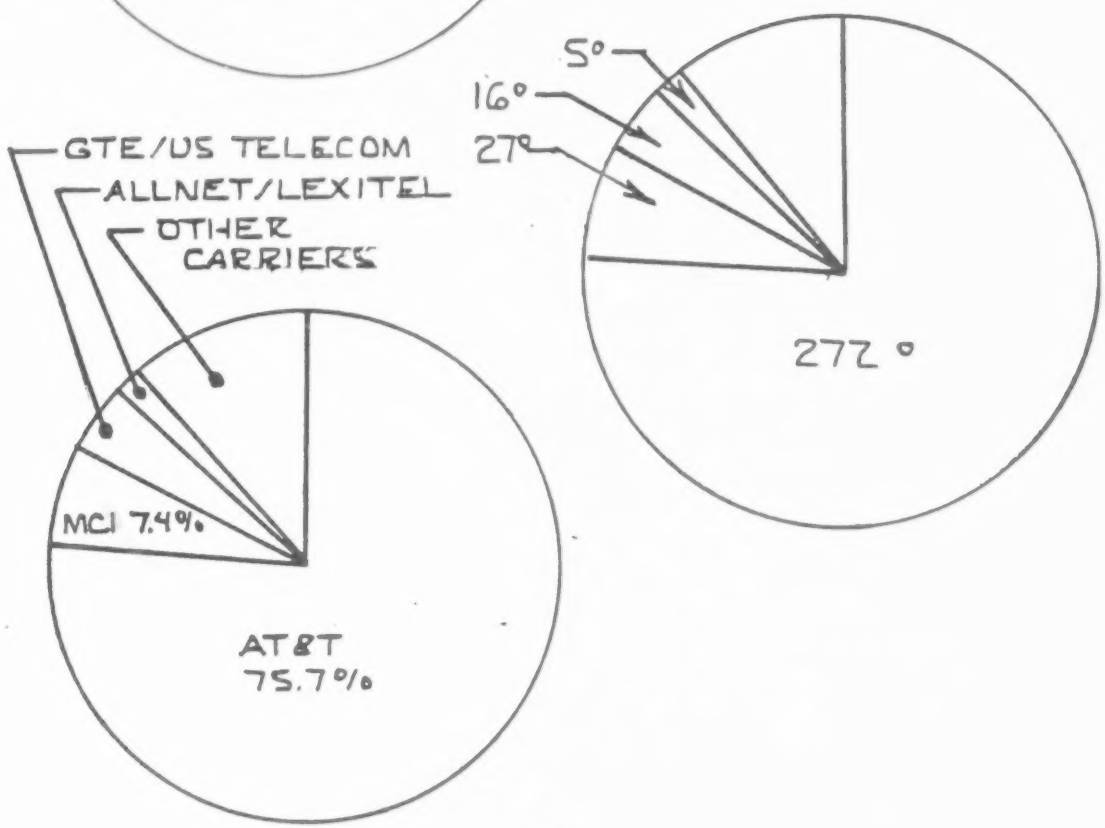
__% × 3.6° = ___°

75.7% × 3.6° = 272.5°

7.4% × 3.6° = 26.6°

4.3% × 3.6° = 15.5°

1.3% × 3.6° = 4.7°



Sketching an Organizational Chart:

The first step in making an organizational chart is to identify and rank the positions in the organization. Ranking is often based on authority and responsibility. Supervisory jobs are typically placed at the top of the chart. Workers are placed below the supervisors. Listed below are students and their assigned clean up jobs. Sketch an organization chart for this class's clean up activities.

Clean-up Assignments

Students	Clean-up Jobs
Mike	Clean-up Supervisor
Jim	Bench Supervisor
Sue	Hand tool Supervisor
Mary	Machine Supervisor
Ken	Benches
Tim	Benches
Judy	Benches
John	Hand tools
Jane	Hand tools
Kim	Machines
Joe	Machines
Kris	Machines

Sketching a Flow Chart:

Flow charts illustrate a process. Communication is a process. The process starts with a sender and ends with a receiver. Listed below are the basic parts of the communication process. Using arrows and different shapes, make a flow chart that shows the communicating process. Label each part on the flow chart.

Sender
Encoding
Transmitting
Message
Receiving
Decoding
Receiver

UNIT: Using the Language of Industry

LESSON 11: Reading Graphs and Charts

Objectives	Lesson Content	Learning Activities	Ref.
A. Following a discussion and demonstration, in a lab activity, using graphs and charts as the only information source, students will be able to accurately complete statements regarding the information being illustrated.	A. Reading Graphs and Charts 1. reading graphs a. reading the documentation b. using the scales c. identifying trends d. making comparisons e. gathering facts 2. reading charts a. reading the ocumentation b. identifying steps in a process c. identifying positions in an organization	A. Teacher Guided Discussion 1. Discuss the importance of being able to read graphs and charts. 2. Using OT #11-1 & 11-2 review role scales and documentation have on graphs and charts. 3. Explain how to identify trends, make comparisons, and gather information using a graph. 4. Explain how to identify positions and relationships on an organization chart. 5. Explain how to identify steps and paths in a process using a flow chart. 6. Provide each student with HO #11-1 and make sure students have paper and pencil. 7. Have students read the graphs and charts and answer the questions provided. 8. Provide individual instruction and feedback as needed. 9. Collect and evaluate the lab activity.	TA #11-1: Reading Graphs and Charts OT #10-2: Graphs OT #10-3: Charts HO #11-1: Reading Graphs and Charts

READING GRAPHS AND CHARTS

Introduction:

Graphs and charts are commonly used communication tools. Collect several examples of print media that use graphs and charts. Good sources for a variety of graphs and charts include things like newspapers (especially the business section), car brochures, automobile magazines (road tests), textbooks, and quarterly reports for large companies. Referring to the examples, discuss why the publishers used charts and graphs. Explain why it is important for consumers, investors, students, and voters to be able to read graphs and charts.

Using OT #11-1 and 11-2, review the role of scales and documentation on graphs and charts. Explain how to identify trends, make comparisons, and gather information using a graph. Explain how to identify positions and relationships on an organization chart. Explain how to identify the steps and paths in a process using a flow chart.

Divide your class into small groups and provide each group with an example graph or chart. Have each group analyze their graph or chart, identify trends, make comparisons, and/or gather information using their example graphs and charts. After a short period of time, have each group report what their example graph or chart was communicating.

Learning Activity:

Provide each student with HO #11-1. Make sure each student has paper and a pencil. Have students read the graphs and charts and answer the questions provided. Circulate around the classroom and provide individual instruction as needed. Before the end of class tell students how they are doing as a group and make whatever general recommendations are necessary. Try to keep your feedback as positive as possible. Collect the lab sheets at the end of the class period. Evaluate the lab sheets in terms of accuracy of the information gathered. When you return the lab sheets, you may want to allow students to correct them on their own time and turn them in for a second evaluation.

READING GRAPHS AND CHARTS

Introduction:

Like all the other types of drawings you have studied, graphs and charts communicate technical information in the form of pictures. Grafts and charts make technical information more interesting and easier to understand. The drafter sending the information needs to know how to draw graphs and charts. The people who can benefit from the information must be able to read the graphs or charts. In your life, you will most likely read more graphs and charts than you will draw. Graphs and charts are common communication tools in science, industry, and business.

Scientists use graphs to record, study, and communicate the information they gather from experiments. Often the steps for the experiment are put in the form of a chart. In chart form, all the scientists and technicians involved in an experiment can understand their role and the roles of others.

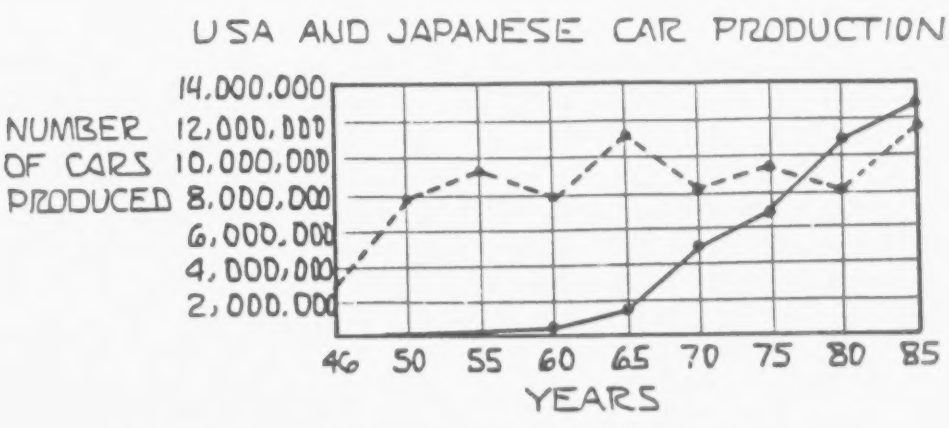
Charts are popular communication tools in industry. Engineers and managers use charts to organize production people, materials and machines. Flow charts are used to record and communicate all the steps required to make a product. Charts are used to show how materials flow through the factor. Graphs are used to show the percentage of defective parts made or how well workers are doing their jobs.

Business people use graphs to show how much money the company is making, who is buying the company's products, and which products are selling best. Organizational charts are used to show each department in the company and who is the boss at each level of the company.

Graphs are used to compare one product with another product in consumer and automotive magazines. You may need to read a chart to find out what is the best product to buy. Charts are often used to illustrate points in a news story. Charts are also used to show the steps for do-it-yourself products and projects. Because graphs and charts are everywhere, consumers should be able to read them.

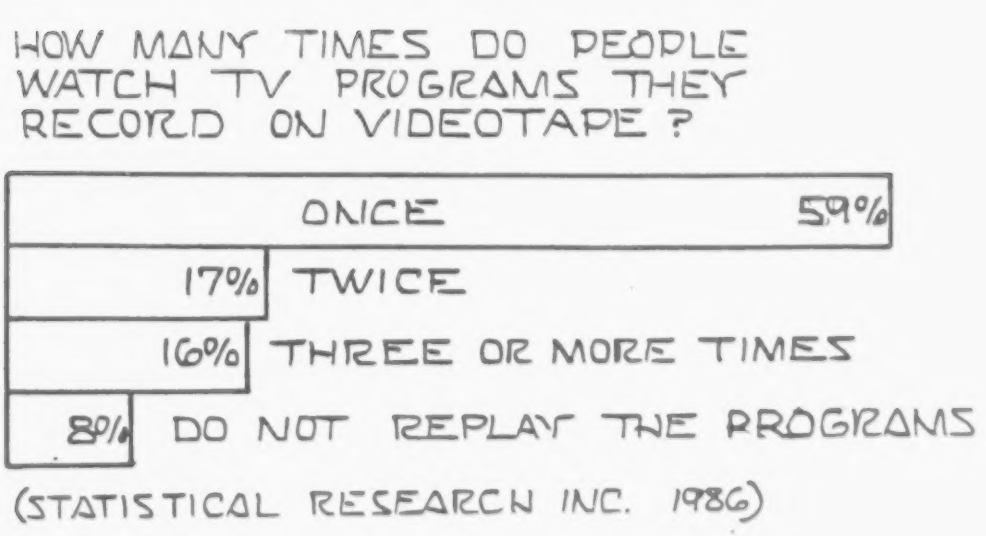
Reading Graphs and Charts:

Directions: Using the graph below, answer the following questions.



1. American automobile production was almost the same in 19__, 19__, 19__, and 19__.
2. The U.S. and Japan produced the same number of cars in about 19__.
3. Japan had the biggest lead on the U.S. in car production in 19__.
4. For the U.S., 1985 was a good year for producing cars. The U.S. produced almost as many cars in 19__ as it did in 1985.
5. In 1950, the U.S. produced about 8 million cars. Until what year did it take for Japan to make as many cars as the U.S. did in 1950?
6. Which country was the leader in car production in 1985?

Directions: Using the graph below, answer the following questions.

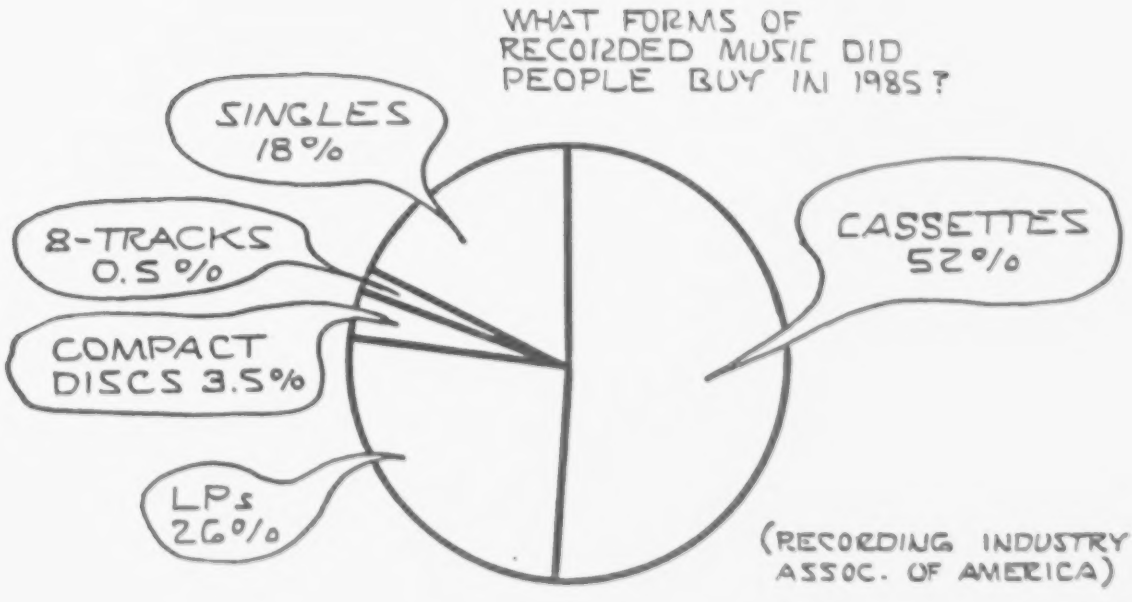


7. About _____ percent of the people who record TV programs will only play them back once.

8. What percent of the people who record programs will watch more than once? _____

9. About _____ percent of the people who record programs do not even watch them.

Directions: Using the graph below, answer the following questions.



10. What is the most popular form for recorded music?

_____

11. What is the least popular form for recorded music?

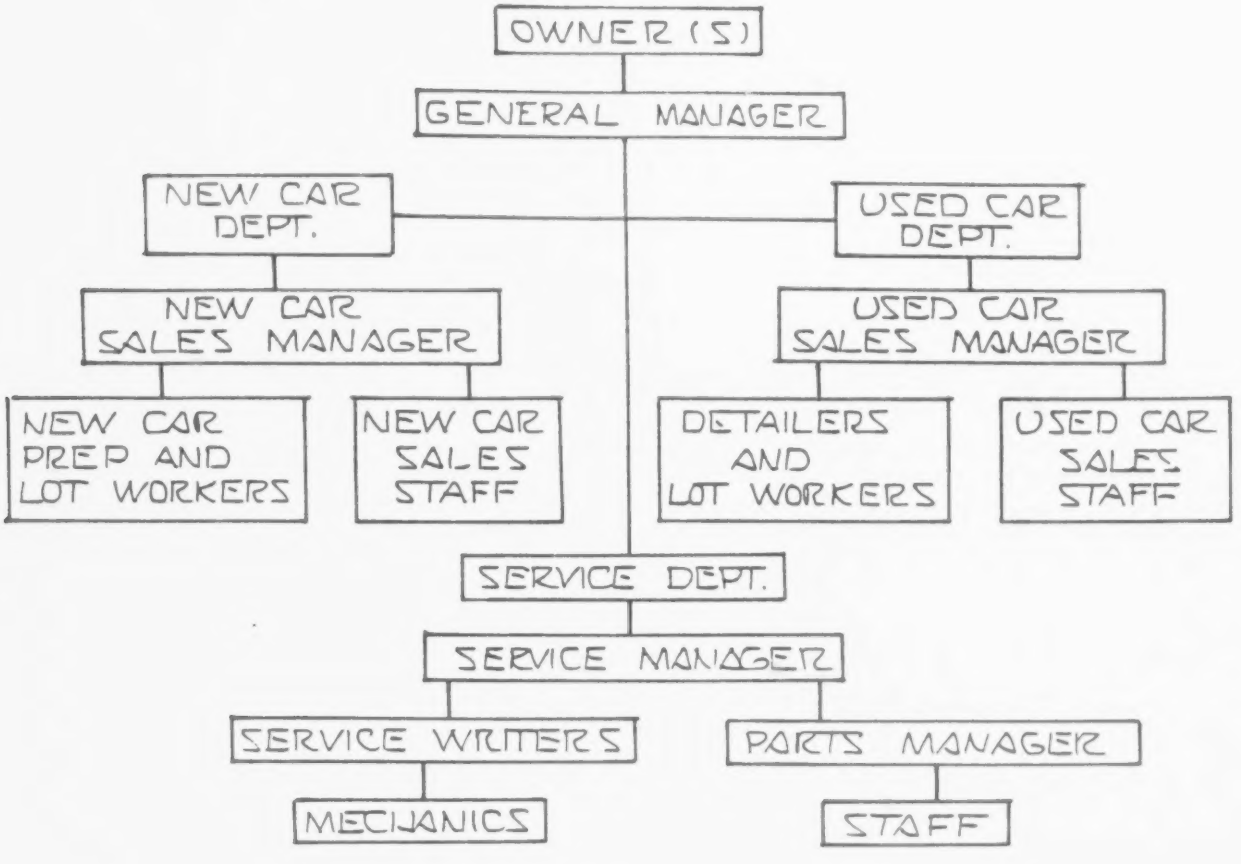
_____

12. About 3.5 percent of recorded music is purchased on

_____.

13. More people prefer buying _____ than all the other forms of recorded music put together.

Directions: Using the chart below, answer the following questions.



14. The top person in a car dealer organization is the _____.

15. What are the three major departments in this organization?

_____

_____

_____

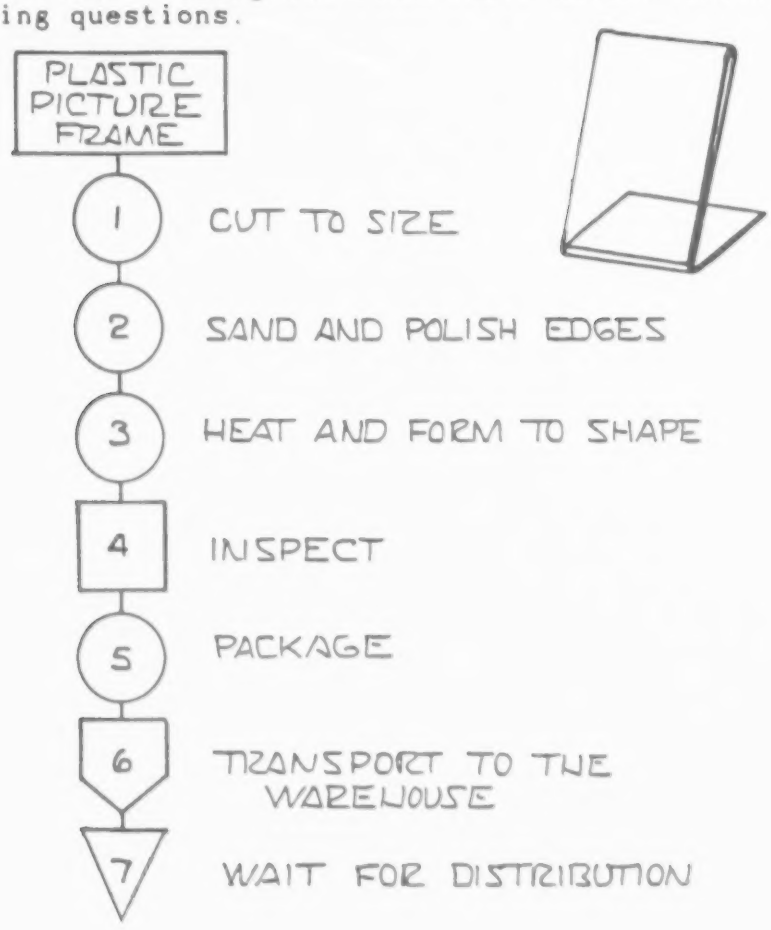
16. The new car manager, the used car manager, and the service manager, all report to the _____ manager.

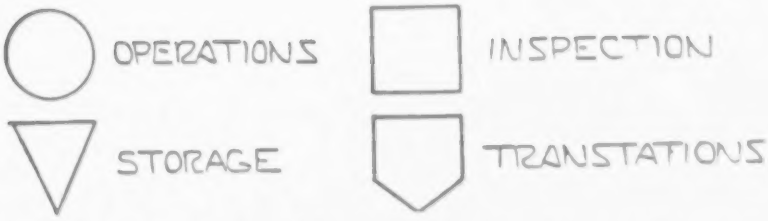
17. What are the two types of sales staff in this car dealer's organization?

_____

_____

Directions: Using the flow chart below, answer the following questions.





18. How many operations have to be performed to make this product?

_____

19. The product is inspected after operation number

_____.

20. Before the product is transported to the warehouse, it must be _____.

UNIT: Using the Language of Industry

LESSON 12: Evaluation

Objectives	Lesson Content	Learning Activities	Ref.
A. Following a review on a written objective test, students will be able to complete given concept statements regarding the language of industry with a minimum of 70 percent accuracy.	A. Review 1. Intro. to drafting communication 2. Basic sketching 3. Pictorial drawings 4. Multiview drawings 5. Reading multiview drawings 6. Architectural floorplans 7. Reading architectural floorplans 8. Schematic drawings 9. Reading schematic drawings 10. Graphs and charts 11. Reading graphs and charts	A. Teacher Guided Discussion 1. Review the major concepts explored during the unit. 2. Provide students with an opportunity to ask questions before taking the test. 3. Provide each student with HO #12-1 and make sure each student has a pen. 4. Explain the directions for the test. 5. Have students read the test and answer the questions provided. 6. Collect tests and grade your students' performance. 7. Provide students with feedback regarding their test performance as soon as possible.	TA #12-1: Evaluation HO #12-1: Unit Test

EVALUATION

Review:

Review the major concepts addressed during the unit. Include in your review communication theory, basic sketching, pictorial drawings, multiview drawings, architectural floorplans, schematics, graphs, and charts. Have students participate in the review by asking and/or answering questions.

Administering the Test:

Have students sit in their assigned location for a test. Provide each student with HO #12-1. Make sure each student has a pen. Explain the directions for the test. After all questions regarding the directions have been answered, have your students begin taking the test. Circulate around the classroom and provide individual help if appropriate. Collect the test at the end of the class period. Evaluate each student's performance on the test. Provide your students with feedback regarding their performance on the test as soon as possible.

UNIT TEST

DIRECTIONS: Read each statement carefully. Circle the letter of the answer you think answers the question best.

1. The process of preparing drawings for things that need to be made or done is called _____.

   A. graph arts
   B. photography
   C. drafting
   D. writing

2. Drafting can be used to _____.

   A. improve an idea
   B. record an idea
   C. explain an idea
   D. all of the above

3. Which of the following is NOT an example of drafting?

   A. plans for a model kit
   B. a diagram of a football play
   C. plans for a house
   D. a photograph of a car

4. Putting the things you are thinking about into words and pictures people can understand is called ____.

   A. sending
   B. encoding
   C. transmitting
   D. decoding

5. Describing and drawing a project is an example of _____.

   A. a sender
   B. transmitting
   C. receiving
   D. a receiver

6. Which of the following is NOT true about sketching?

   A. sketching helps you see and record your ideas
   B. sketching can help you solve a problem
   C. sketching requires special drawing tools
   D. sketching is a valuable communication tool

7. Which of the following drawings would show the most detail if you wanted to make a rocket?

A. multiview drawing
B. pictorial drawing
C. schematic diagram
D. one view sketch

8. When sketching an object,you should NOT ___.

A. draw light line first
B. use arm motions to draw
C. sit in a relaxed and upright position
D. draw the details first

9. The easiest type of technical drawing to understand is a ____.

A. multiview drawing
B. pictorial drawing
C. schematic diagram
D. floorplan

10. Drafting is often called ____.

A. a graphic art
B. the language of industry
C. visual communication
D. commercial art

11. The type of drawing used to communicate information about a structure is called ____.

A. an architectural drawing
B. a schematic diagram
C. a multiview drawing
D. one view sketch

12. To show how an electronic or a fluid power system works, you would use a ___.

A. multiview drawing
B. pictorial drawing
C. floorplan
D. schematic diagram

13. The best drawing for showing all the jobs in a company is a ____.

A. flow chart
B. pictorial drawing
C. organization chart
D. bar graph

14. The best graph for showing a change over a period of time is a ____ graph.

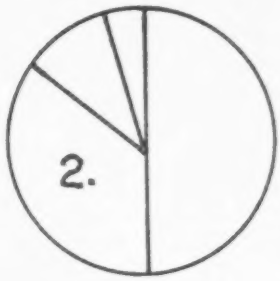
A. line
B. bar
C. pie
D. all of the above

15. The basic shape used to start drawing the TV set is a _____.

A. circle
B. cube
C. cone
D. cylinder

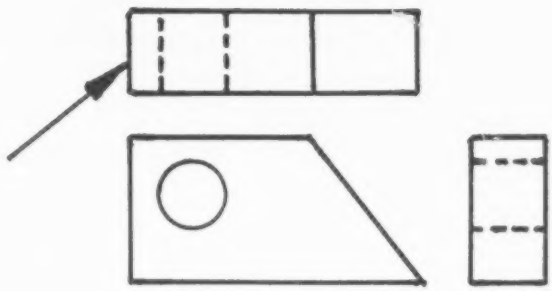
16. Segment number two in the pie graph represents about ____ percent.

A. 5
B. 10
C. 35
D. 50



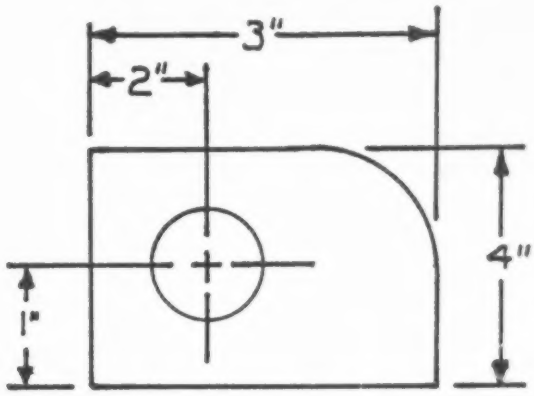
17. The arrow is pointing to the ___ view on the multiview drawing below.

A. top
B. front
C. right side
D. left side



18. Which of the dimensions on the drawing below would show the object's overall length?

A. 1
B. 2
C. 3
D. 4

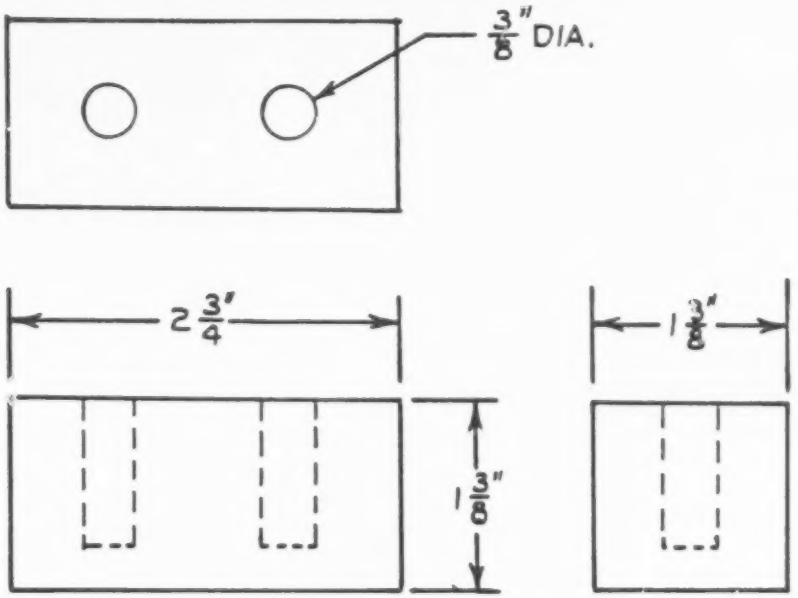


19. To show a carpenter the location and size for a room addition, you would sketch a ____.

A. back view of the house
B. sideview of the house
C. front view of the house
D. floorplan for the house

20. The only thing the drawing below communicates is ____.

A. where to drill the holes
B. how big to make the product
C. what kind of material to use
D. how deep to drill the holes



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